THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXIX. No. 2175.] LONDON, JANUARY 17, 1905. [57TH YEAR. PRICE 6d.

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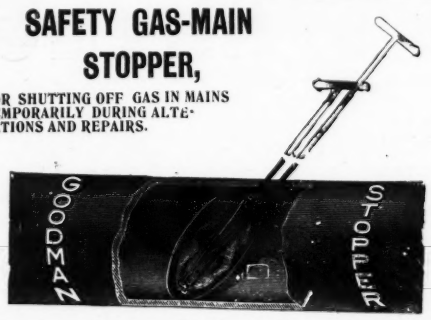

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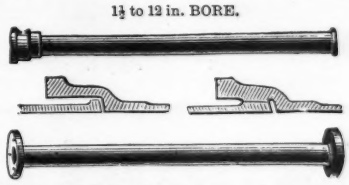

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	£	s.	d.
Water used in boilers from Dec. 9 to Dec. 16, as per Corporation meter .	79,300		
Fuel used from Dec. 9 to Dec. 16: Coke dust—41 tons 4 cwt., at 1s. 11d. .	3	19	0
Washed slack—15 tons 17 cwt., at 6s. 6d.	5	3	2
	£9	2	2

This works out at a fraction under 2s. 4d. per 1000 gallons. Can this result be beaten? I may add that the water-feed to the boilers is heated by the exhaust steam from the engines to 200 deg.

Yours truly,
C. D. LENG.

High Street, Sheffield, Dec. 19, 1904.

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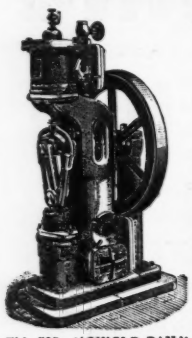

Fig. 705. "SINGLE RAM" STEAM-PUMP.

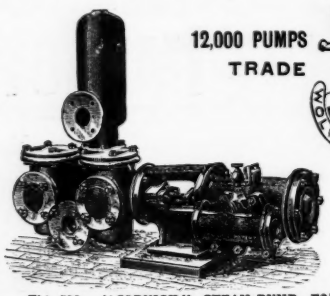

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

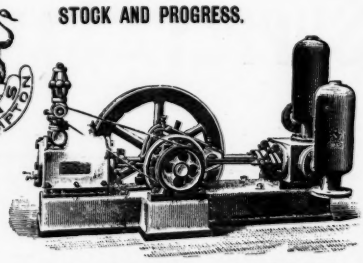

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

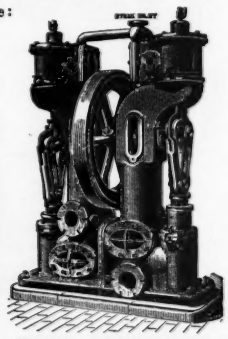

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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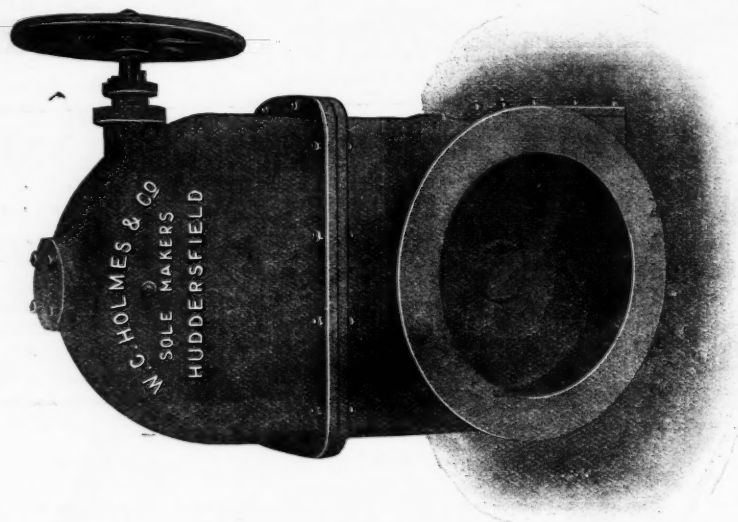
MADE IN HORIZONTAL OR VERTICAL FORM from 3 in. to 48 in.



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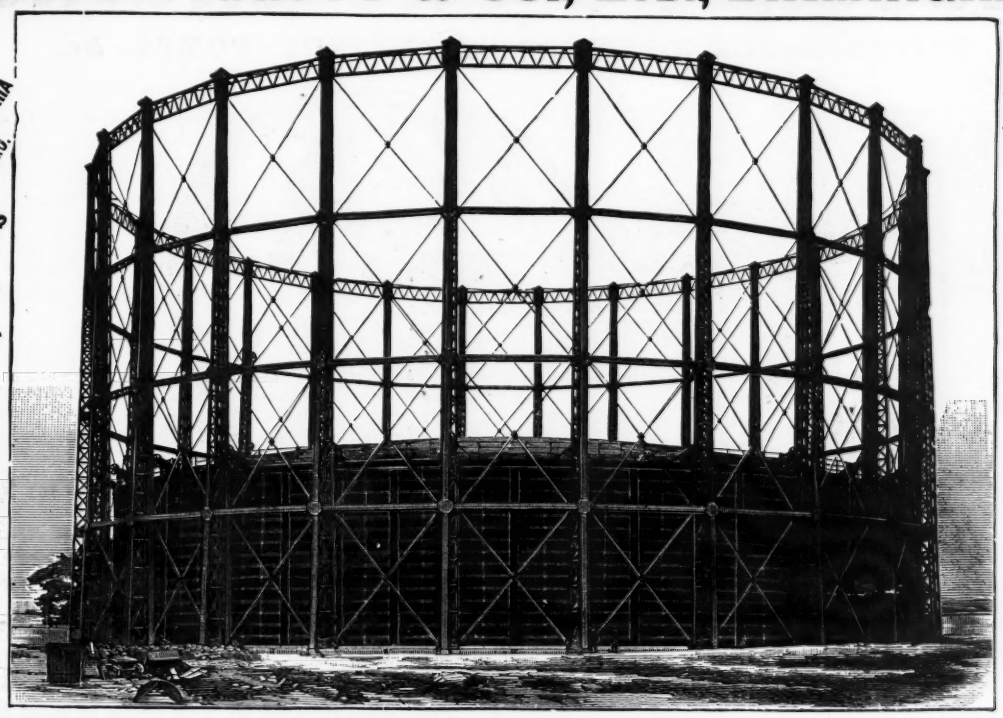

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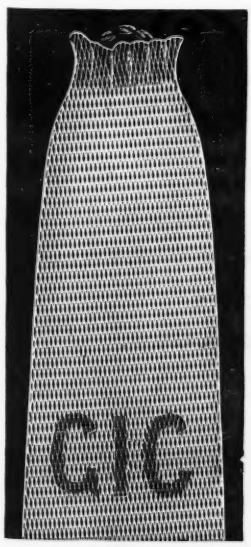

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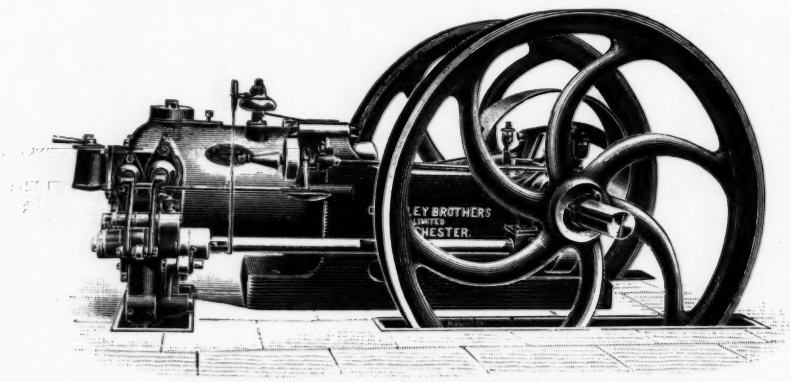

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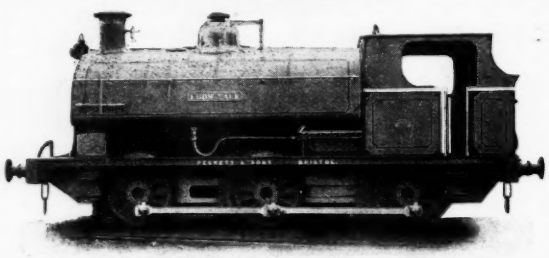

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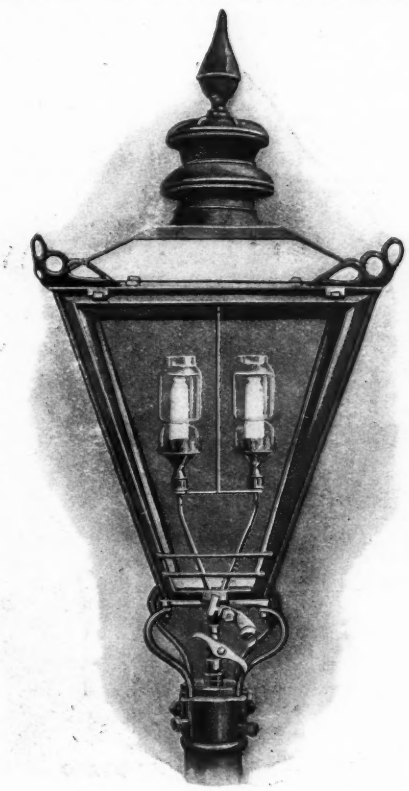

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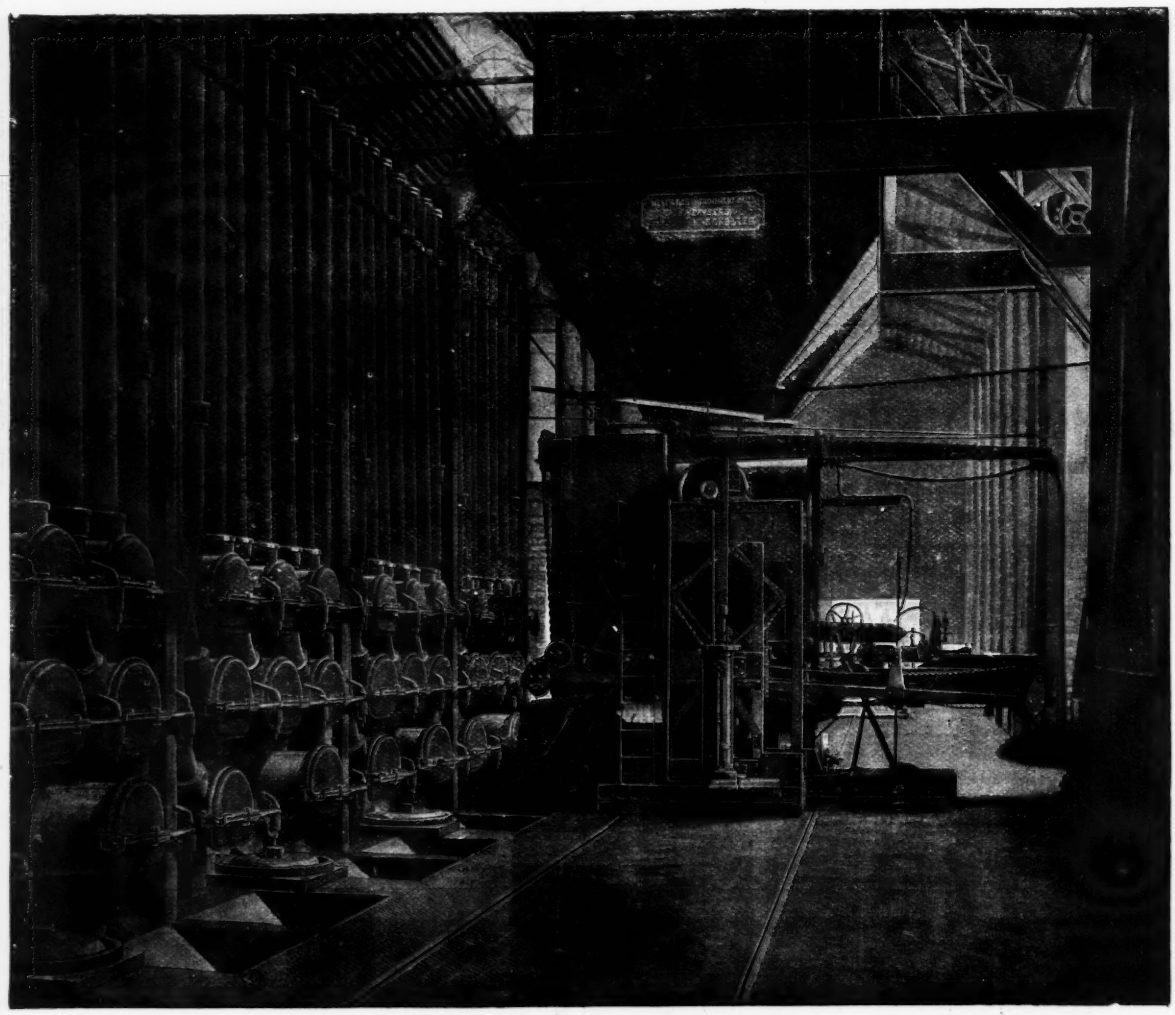

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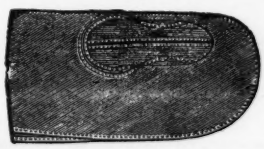

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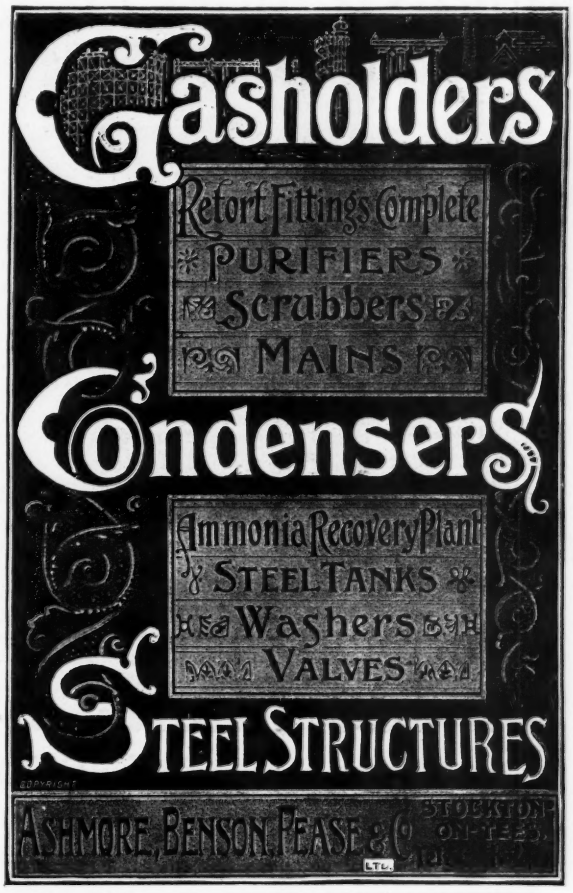

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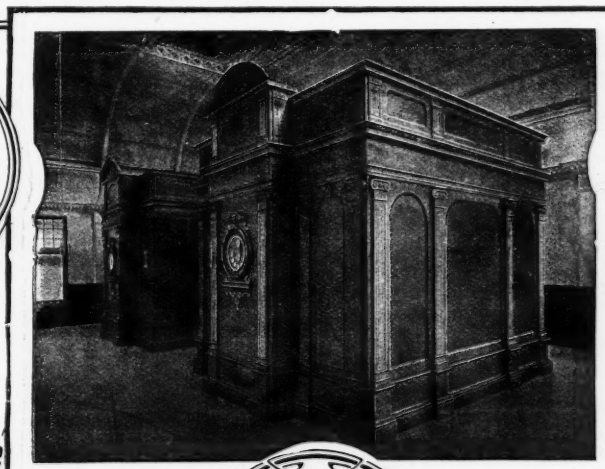

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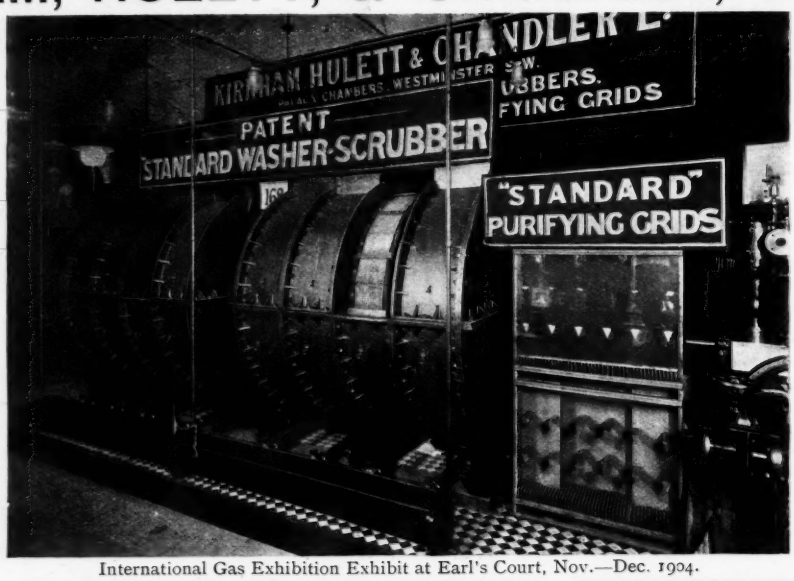

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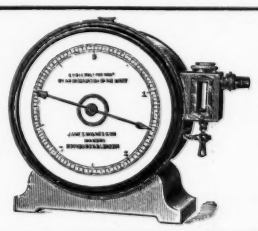

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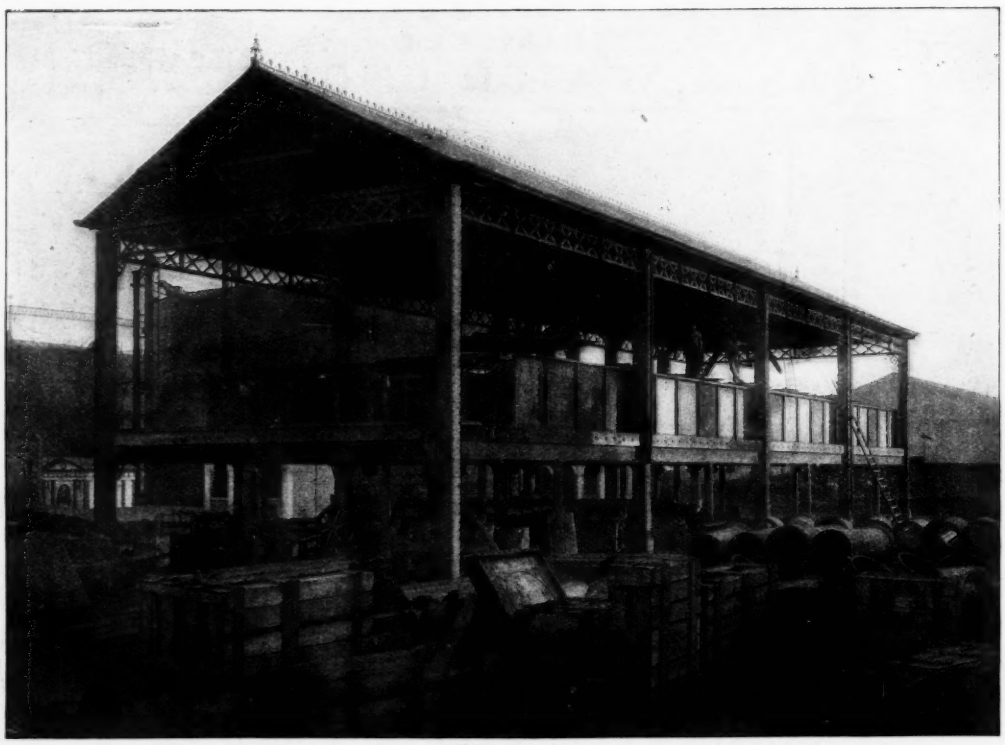

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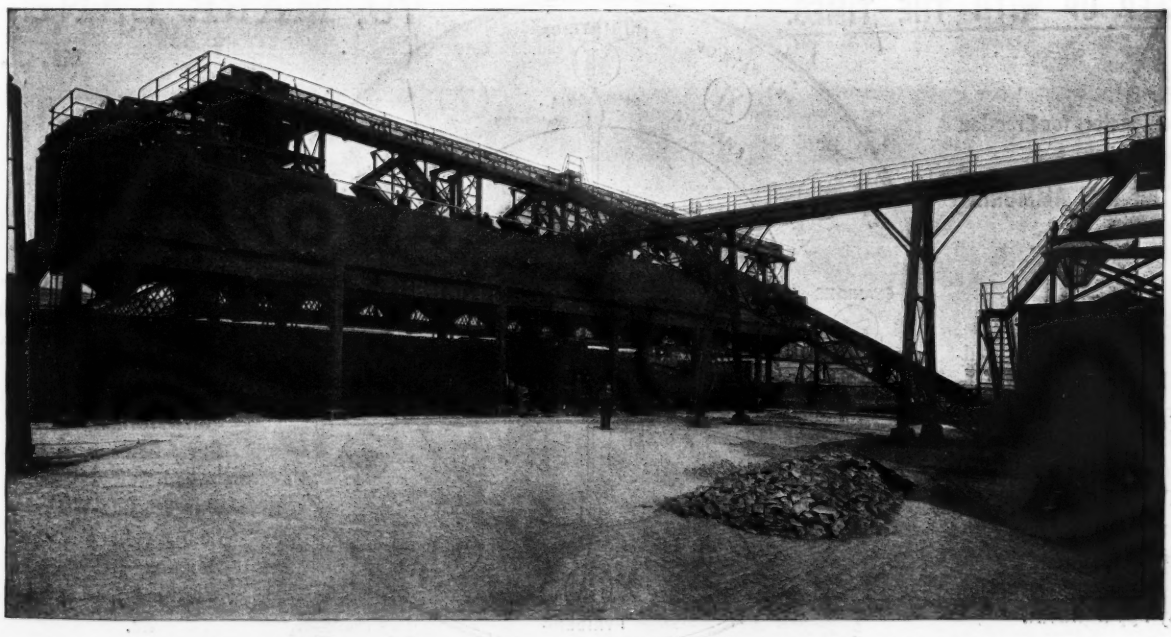

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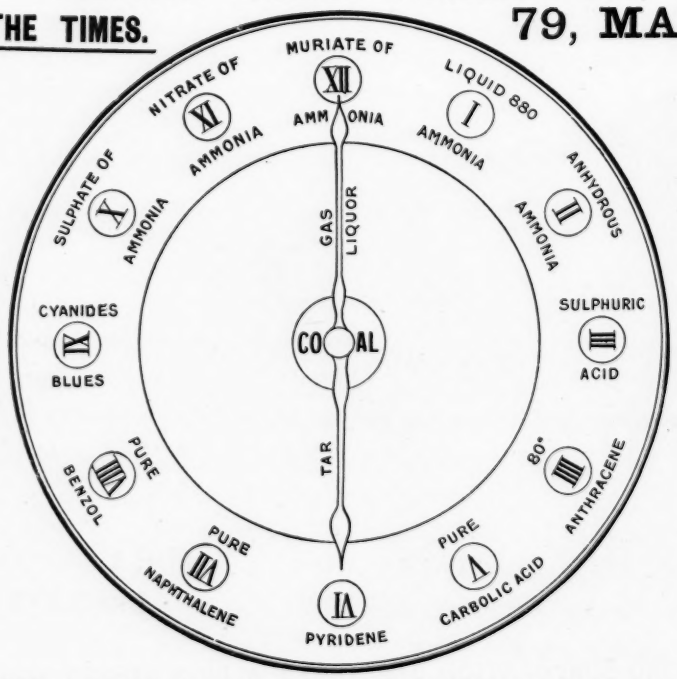

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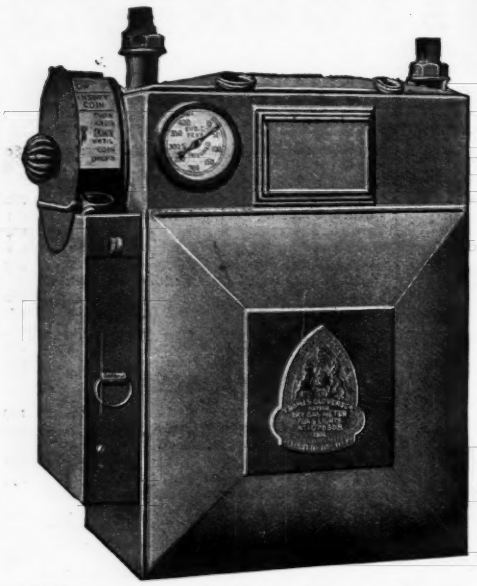

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EDITORIAL NOTES—GAS, &c.

The Patents Act, 1902.

THE new Patents Act came into force with the New Year, at the instance of the Board of Trade, who have put into operation, as from the 1st of January, the provisions of the Act as therein provided. Its working will be watched with considerable interest, and, it may also be said, with some amount of anxiety. It will be recollected that hitherto the main difference between the Patent Laws of England and those of America and Germany has been that, whereas in this country patents have been granted to all comers without any question arising as to the degree of originality they may have possessed, in America and Germany an exhaustive investigation precedes the granting of a patent, which, in fact, is refused if such investigation should disclose, in the opinion of the examiner, that the patent applied for has been anticipated. This system has had great attractions for many, notwithstanding the power it places in the hands of the examiner, who may or may not be thoroughly competent; and attention was called in these columns, on the 23rd of August last, to two notable failures of justice that had occurred through the apparent inability of the Patent Office authorities to recognize the novelty of inventions submitted to them. How many more there may have been of which no one has ever heard, can only be conjectured. It is not improbable, however, that those who have been most clamorous for an alteration in the English Patent Laws in this respect have had the least acquaintance with the effects of the working of the American and German systems. They have become enamoured of the idea that the State which grants a patent should, in some way or other, invest it with value.

Hitherto the onus of maintaining a patent and of proving its validity has rested entirely upon the owner of it; as likewise has rested upon the objector the onus of proving its invalidity. Now, however, the Patent Office authorities have been constituted the judges of the novelty or otherwise of a patent; and they must exercise their functions before one is granted. Where an application for a patent "has been "made, and a complete specification has been deposited by "the applicant, the examiner shall forthwith . . . make a "further investigation for the purpose of ascertaining whether "the invention claimed has been wholly or in part claimed "or described in any specification (other than a provisional "specification not followed by a complete specification) "published before the date of the application, and deposited "pursuant to any application for a patent made in the "United Kingdom within fifty years next before the date of "the application." If the Comptroller of Patents, upon receiving the report of the examiner, is not satisfied that the invention claimed has not been either wholly or in part claimed or described in a previous specification, he shall, unless the specification be amended so as to remove the objection, determine whether reference is to be made in it to any prior specification "by way of notice to the public;" no liability being incurred by the Patent Office in so doing. There does not appear to be any intention to refuse a patent on the ground of the invention to which it relates having been anticipated. Indeed, any such provision would have been superfluous, since it should be quite enough to endorse a specification with a reference to prior inventions. Any patent so endorsed may almost be regarded as still-born—at all events, its value would be seriously discounted. It will be interesting to note the action of the examiners in this regard. It will probably have the effect of stopping off a number of transparent repetitions of previous inventions, which might or might not otherwise see the light.

Many applicants, relying upon the search which it is provided shall be made, will not, in all probability, now trouble themselves to ascertain beforehand if their invention has been anticipated; and, if so, the number of such repetitions will be increased. But, lest an examiner or the Comptroller of Patents should go astray in this matter of reference to prior specifications, it is provided that an appeal shall lie from the decision of the latter to the Law Officer. Having regard to the matters which may be at stake, it is highly important that there should be an appeal of some kind from the decision of the Comptroller, though whether this is best provided for by reference to the Law Officer is open to question. It may be doubted if any lawyer is competent, unaided, to decide a question as to priority of invention; and herein, as would seem, the Patent Office has now been invested with duties which are beyond its strength to perform efficiently. There is considerable risk either of injustice being done to applicants, or of the Act itself becoming practically a dead-letter. The advantages which it may be the means of conferring, either upon inventors or upon a more extended circle of the public, are not obvious at present, however much it is possible that they may become so after experience has been gained of the Act in working. So far as this country is concerned, it is an experiment in legislation which can only be justified by its results.

The Market for Sulphate of Ammonia.

THE annual publication by Messrs. Bradbury and Hirsch, of Liverpool, of "A Review of the Market for Sulphate of "Ammonia," is of service to producers, by the material which it affords for a fairly accurate forecast of the position. Its appearance is therefore always looked forward to with considerable interest; and our summary of the "Review" just issued, which will be found in another column, will show that confidence in it as a trustworthy guide is not misplaced. At the same time, the authors would be the last to claim infallibility for their predictions. All that they can do is to place before their readers the actual facts upon which probabilities may be founded. It is observed at the outset that the sulphate of ammonia and nitrate of soda trades are "world trades," and this, as regards the former, is supported by tables showing that of the total production from all sources in the United Kingdom during 1904, amounting to 244,500 tons, no less a quantity than 177,000 tons was exported. Our principal customers are Spain, Germany, Java, and France, with consumptions of 48,418, 23,162, 21,464, and 10,555 tons respectively; other customers being Belgium, Italy, the Canaries, Holland, British Guiana, the West Indies, Mauritius, the United States, Japan, &c. It is noticeable that, despite the war, Japan took last year 14,981 tons, against 3612 tons in 1903; and that a similar demand is anticipated this year. At the same time it is pointed out that in Japan nitrate of soda is likely to be a serious rival to sulphate of ammonia, owing to the latter being handicapped by heavy freights.

A consideration of the cosmopolitan character of this trade naturally leads to an examination of the conditions which have affected agriculture during the past year, as represented by the three principal crops—namely, wheat, cotton, and sugar. The first-named does not materially influence the market for sulphate of ammonia; but it is pointed out incidentally that the shortage of wheat from the United States seems to indicate that the time may be drawing near when that country will cease to export it. Whether this be so or not, it is certain that a great development is in store for the wheat lands of Canada and elsewhere, to meet the ever-growing demand from importing countries. Cotton claims attention because of its importance to one of the greatest of our home industries; and it is interesting to note that, though the very abundant crop of last year, which converted a serious scarcity into plenty, was primarily due to favourable weather during growth and throughout the picking season, and in a lesser degree to the cotton area being extended, it is also to be attributed, to some extent, to a more extended use of fertilizers. Sugar, however, is of the very greatest importance with respect to the consumption of fertilizers; and, as regards this, it is stated that last year there was no reduction in the area devoted to the cultivation of beet—the shortage in the Continental crop of which, representing 1,000,000 tons of sugar, being due to long-continued

drought during the growing season. This shortage has necessarily caused an advance in prices, which may be expected to stimulate production during the next year or two, and create an increased demand for fertilizers in the shape of either sulphate of ammonia or nitrate of soda. It is not, however, altogether satisfactory to find that the average price realized for sulphate of ammonia in 1904—namely, £12 3s. 8d. per ton—was less than that for 1903, when it was £12 9s. 2d. per ton; and that this compares unfavourably with the position of nitrate of soda, the average price obtained for which in 1904 was £10 4s. 2d. per ton, against £9 10s. 10d. per ton in 1903. This shows an actual increase of 13s. 4d. per ton, compared with a decrease of 5s. 6d. per ton in the case of sulphate of ammonia. Messrs. Bradbury and Hirsch appear to attribute this, in some measure, to an error of judgment on the part of producers in stocking in the early spring months, instead of selling their output. This might have caused a temporary reduction in prices, with the effect, however, of increasing the Continental demand at a critical time, so that a recovery might have come sooner. Nothing, it is said—and no doubt truly—encourages "bear" speculation so much as knowledge that there are stocks in the hands of producers.

As regards production, there appears to have been an increase of 4000 tons from gas-works in 1904. The production from this source alone now amounts to 154,000 tons, compared with 134,000 tons in 1899. The production from iron-works remains practically stationary, at 19,000 tons; while that from shale-works shows an increase of 2000 tons, and now amounts to 39,500 tons. Coke and carbonizing works and producer gas account for 32,000 tons; having increased from 15,000 tons since 1899. It is observed that the Mond power gas process has not been extended so rapidly as was predicted; and the increase from this source is estimated at only 2500 tons. It may be noted, in conclusion, that the increased production from all sources since 1900 (namely, 31,500 tons) is almost exactly balanced by the increase in the quantity exported, which has risen in the same interval from 145,285 tons to 177,287 tons—showing an increase of 32,002 tons. Our home consumption for all purposes has, according to these figures, remained stationary, notwithstanding the efforts that have been put forth by the Sulphate of Ammonia Committee.

An Electrician on Street Lighting.

THERE is a depression, and quite an intelligible one, in the market for street lighting by electricity. It is recognized by the electrical press and by station engineers; and all sorts of whimsical ways and means are being invented by the latter to resuscitate patronage of this branch of their business, but with little success. We are not surprised at this; and for the reason that those who essay to construct something of a parallelism between electric arc lighting and incandescent gas lighting, on the bases of economy and efficiency, generally land themselves into palpable paralogism—so palpable, indeed, that a business man does not require to be an electrician to detect the fallacy. One of the latest to proclaim himself as having joined the band of illogical station engineers is Mr. H. B. Maxwell, the Burgh Electrical Engineer of Partick. The occasion, as will be seen by the report in another column, was a meeting of the Glasgow Section of the Institution of Electrical Engineers last Tuesday, and a paper was the method he adopted for giving publicity to a number of erroneous views. On reading the paper, those electrical engineers and local authorities who have gone in on a luxurious scale for electric arc lighting, and whose lighting rates have in consequence assumed a character that has brought the ratepayers to the verge of revolt, and in certain cases beyond the verge, will not thank Mr. Maxwell for being the author of a mass of material which inferentially alleges that they deserve to be placed in a category labelled with an objectionable name, and that wisdom superior to their own is to be found in Partick. Truly this suburb of Glasgow ought to rejoice in their possession; and Mr. Maxwell should henceforth be in great demand by those municipalities who do not know how to deal with their own street lighting.

We have for some time been under the impression that the reason electric arc lighting for street purposes cannot make much headway now that there has been a considerable accumulation of experience is that the system is costly, and lacks the uniformity in efficiency that is to be obtained from the much less expensive incandescent gas lighting. Mr. Maxwell would have those who believe with us, and those electrical engineers who dare not reduce the charges for street lighting below present prices, to understand that such opinion is altogether faulty. The chief reason, he tells us, why arc lighting has not been more extensively used in streets is that station engineers do not charge rates low enough to make the light commercially practicable. Not low enough! We have yet to learn where the local authorities exist who are not already getting their electricity for public purposes considerably (having regard to the smallness of the unit on which the charge is based) under the price which private consumers have to pay. Mr. Maxwell's estimate of a low charge is 1d. per unit. There are several local authorities who are supplying electricity for public lighting at a price a fraction above that figure; and we guarantee that, in the innermost recesses of the hearts of many of the station engineers who are struggling along with that price, there lurks the wish that they could have a bit more put on to it. But Mr. Maxwell has another surprise for us and for the men of his own profession, when he asserts that the main object of station engineers seems to be to cram as many lamps as possible into the streets available, so as to increase the revenue, with no considerations of economy, or of the most suitable positions of the lamps with the view to extensions. Judging by the variegated nature of the surfaces of most streets which electric arc lamps are supposed to illuminate with unapproachable splendour and uniformity, we cannot agree that electrical engineers can be charged with the sin of lavishness in respect of the number of arc lamps adopted.

These are the methods by which Mr. Maxwell seeks to create something like an equality between incandescent gas lighting and electric arc lighting—by putting the arcs on more favourable terms, and by producing a greater inefficiency than at present exists in connection with them in the streets. His remedy will not appeal to those whose motto in public affairs is efficiency with economy, and who have a preference for conducting their business on the principle that every contract or bargain should produce, unless it be unavoidable, its fair share of profit. Consider the methods by which the author arrives at his 1d. per unit as the charge for current for street lighting. To describe them as even "plausible" would be doing an injury to the term; and we are inclined to think that most business men will not hesitate to use the more apposite description of "foolish." The only items, in Mr. Maxwell's view, that should be included in the charge for current for street lighting are the works' costs, *exclusive*—note this!—of wages and interest, sinking fund, and depreciation on the capital cost for boiler, generator, and condenser plant. The cost of cables, feeders, and switchboards he debits against the capital cost of street lighting. Then, proceeding, he says—

> So that £40 per kilowatt demanded, even after providing for a small amount of spare plant, would be more than sufficient to cover the increased cost of station plant due to the street lighting. On this sum 8 per cent. interest, &c., would be a charge of £3 4s. per kilowatt per annum, which, at 3500 units per kilowatt per annum, works out at 0·22d. per unit. Any other items, such as insurance or office costs, that might be increased by the addition of street lighting, would be amply provided for by 0·03d.; so that a station could supply for street lighting at the following rate: Works' costs – wages + 0·25d. If considered necessary, a small addition to this price might be made for profit (every 0·1d. adding £280 to the revenue from 400 lamps); but, in the author's opinion, no such increase is needed, as the decreased cost per unit of coal, stores, and repairs (especially this last item), owing to the much better load-factor, would in itself cause a considerable profit.

That is how the 1d. per unit is reached; but is it necessary to discuss the statement to show the absurdity of running any branch of business on such lines? If "considerable "profit" is to be made in this way, then, in the name of common sense, let us have every street and every back alley superbly lighted by electric arc lamps, and so increase to the highest point possible this miraculous "load-factor." If we are mistaken, perhaps Mr. Maxwell will be good enough to define the point where the "considerable profit" will end in the conduct of business in electric street lighting on the methods laid down by him.

Blindness to the truth and imagination misapplied and stretched are the characteristics of this paper; and especially so in the author's denunciation of incandescent gas-lamps and in his comparisons of the two systems of lighting. But further criticism is superfluous, seeing that Mr. Alexander Wilson was at the meeting, and dealt out a severe rebuff,

though in charitable language, to the fallacious reasonings and arrogant assertions with which the author had packed his paper. Besides this, there is all around us the controverting, living evidence in our favour, which cannot be strangled by the assumption and wild fancies of those who find themselves hard pressed.

A Workman's Compensation Question.

THE decision of the Court of Appeal in the case of *Clark v. The Gaslight and Coke Company*, which was given on Friday, is one of considerable importance to all employers of labour. The circumstances which led to it, as they appear in our report of the proceedings, may be briefly recapitulated. The respondent, Clark, was a coal porter in the service of the Company, who in the course of his employment met with an accident which resulted in the loss of part of the fingers of his left hand. His wages were 41s. 9d. per week; and the Company agreed to a compensation of £1 per week under the Act. Afterwards, they offered him employment as gate and time keeper. This he refused to accept until his Honour Judge French made an order reducing his compensation allowance to 14s. 9d. per week, which was the difference between his old rate of 41s. 9d. and that of 27s. which he could earn by accepting the post of timekeeper. Clark, however, persistently refused to perform certain duties relating to the latter, on the ground that such performance would be "spying upon his fellow-"workmen." He was eventually dismissed by the Company, and then applied unsuccessfully to the County Court to have the amount of his compensation increased to the original £1 per week. Renewing his application, however, fourteen months afterwards, he was successful. It was against this decision that the Company appealed.

Mr. Danckwerts, K.C., who appeared for the appellants, seems to have relied upon the absence of any evidence of incapacity to earn wages; it having been clearly shown, when the compensation was originally reduced, that the man was fully capable of performing the duties of such a position as that of gate and time keeper. Since then there had been no change of circumstances; and the only fresh evidence adduced went to show that the man had made various applications for employment as gatekeeper, but had been unable to obtain it owing to there being no vacancies. Stress was laid upon the fact (which it was stated the County Court Judge had ignored) that Clark had a safe post where he was earning 27s. per week, but had lost it through his refusal to obey the lawful orders of his employers. He was therefore in the position of a man who was capable of work and was voluntarily idle. Further, Mr. Danckwerts contended that the fluctuations of the labour market had nothing whatever to do with the question, which depended entirely upon the man's physical ability to do work of any kind; nor did the Act intend to give a man a licence to abstain from work altogether because of an accident, or throw upon the employer all the risks of there being no employment of another sort obtainable by an injured workman. Their Lordships, however, without calling upon the respondent's Counsel (Mr. Powell, K.C.) to reply, gave judgment, dismissing the appeal with costs.

The Master of the Rolls, in delivering his judgment, expressed the opinion that the contention that the state of the labour market to which the man became restricted by reason of his accident, is not an element to be taken into consideration, but that the mere fact of his physical capacity to perform work if he could get it is enough to exclude the right to compensation, was contrary to common sense; nor was it involved in any of the authorities that had been cited, much less in the actual words of the Act itself. The scheme of the Act is one for compensation for inability to earn wages. What is intended is to give compensation not fully but partially—to give something that is not an equivalent, but something it is thought will be compensation for incapacity to work. An accident arises by which a workman is shut out from his particular class of occupation. The Legislature makes the standard of compensation the difference between what a man was able to earn in the original employment and what he is able to earn after the accident; the effect of diminishing his physical capacity being to narrow the area of possible occupation. In this particular case, employment for which the man was physically fit was at once found for him, at wages which made the compensation of 14s. 9d. per week adequate. He was rightfully dismissed from that employment for misconduct. This affected the question at the time, because it was then open to the County Court Judge, to whom the man immediately appealed, to hold (as he did hold) that the reason why the man was not then earning wages was that he would not keep the place open to him. After a long interval, however, matters were changed; and the man could not be visited permanently with the consequences of his wrongful act in disobeying orders in that particular employment, which would take the shape of his being debarred for ever after from getting compensation, although he could not get employment. The ancillary provision that compensation for an accident is to be reduced according as the man's capacity for work improves, is a provision in relief of the employer, who gets the benefit of it. But in this case—through reasons for which the man could not fairly be deemed responsible—he could not get the opportunity of putting his diminished earning powers into operation so as to earn the diminished amount; and therefore the master could not be relieved by giving him credit for the wages which the man was debarred by his physical condition from earning. The County Court Judge had, in fact, come to the conclusion that, under existing circumstances, the man could not get employment; and he therefore refused to give the master the benefit of the hypothesis that the man could get it.

It will be noted that this judgment effectually disposes of the idea—if it were ever seriously entertained—that the physical capacity to earn wages is of itself sufficient to relieve the employer from liability to pay compensation for accidents. A man must not only be able to work, but also able to get work, in order that his employer may obtain relief from liability with regard to him. There will be general agreement with the opinion of the Master of the Rolls that this is a common-sense view of the matter; nor is it less satisfactory to observe, in connection with the case, that, while punishment is rightly administered for misconduct, it does not follow that this should be made permanent. On the contrary, much has to be condoned in a man under the circumstances of the respondent in this case.

The Theory of the Incandescent Mantle.

"SPECULATION has been rife as to the causes which lead to "the incandescent mantle giving us 20 candles of light per "foot of gas consumed, instead of the small fraction of that "amount obtainable when we rely upon the incandescence "of carbon particles in the flame for the production of gas." Those were among the words that prefaced a lecture, which will be read far and wide, delivered by Professor Vivian B. Lewes before the Junior Institution of Engineers last Friday night; and the Institution must count it a great honour that the Professor should have chosen this occasion to publicly examine, and express his deliberate views upon, the latest writings and deductions from experiment of investigators into the question involved in the quoted sentence. True the incandescence of the gas mantle still offers a wide field for speculation and research; for the *savants* are even as far apart from precise agreement as to the causes of that incandescence, and as to why 0·5 to 1·5 per cent. of ceria, and no other proportion, should have the wonderful effect it possesses of awakening the light-giving power of the mantle, as they have been at any time. This fact is brought sharply into view by the glance taken by Professor Lewes, in this single lecture, over the work that has been done in this direction. But the layman may say, Of what earthly use to me will be a settlement of the question? Suffice it that I can get 20 candles per cubic foot of gas by the use of a mantle. The answer is that, apart from the scientific interest, the greater our knowledge of the combination of forces which produces for us such a remarkable effect, the clearer the road will be to further progress.

In the efforts to elucidate the remarkable power of light emissivity produced by mere traces of ceria in the composition of the mantles, Professor Lewes has done a large amount of work—particularly in putting to the test the value of the theories advanced by other workers. The inclination of his view is revealed by the statement in his lecture on Friday that the theory which always appealed most to him was the catalytic one, as enunciated by Dr. Bunte; and now that the Doctor has discarded it in favour of a theory of selective radiation, Professor Lewes tells us that he personally feels more disposed than ever to champion the

former, as it undoubtedly plays an important part in raising the temperature of the mantle. It will therefore be found that in his lecture he devoted some time to expounding the catalytic theory, and subsequently the more modern work on temperature and radiation. That the catalytic vigour of the mantle is sufficient to keep it, for an appreciable space of time, incandescent in a mixture of gas and air without the exterior heating of a flame, but after having been heated up in it, was demonstrated by an exceedingly simple experiment that, it will be seen, any reader can make for himself. The lecture is, as are all the public utterances of Professor Lewes, so full of good points, that we have only to call attention to it here to ensure that readers will peruse the whole with avidity. They will see that the Professor leaves himself on very safe ground in his closing sentences, where he says he is quite prepared to accept the evidence adduced by Le Chatelier, Nernst, Schmidt, and others, "in which case catalysis, tem- "perature, and selective radiation all play their part in "bringing about that wonderful light emissivity which has "made the incandescent mantle the saviour of the gas in- "dustry." It will also be remarked that this year a number of experiments have been made in the laboratories at Greenwich in connection with this subject, the full details of which Professor Lewes hopes to publish shortly. We shall watch for them with interest.

Electric Light Cables and Explosions.

How frequently in the olden days the gas supply was incriminated in respect of the explosions that occurred in electric lighting conduits and boxes; but there was nearly always the element of uncertainty about it, seeing that the electricians in most cases failed to point out how the gas found entrance into their property. Then there came a day when there were some serious explosions in the City; and it was discovered that the cables themselves (through their bitumen coating) were their own producers of inflammable vapour, and that it was this that must have been responsible for much of the mischief ascribed to coal gas. Since that discovery, coal gas has not so often had to endure this calumny; and much less notice is now taken of these explosions than formerly. We have been reminded of those old days by a letter on "Cable Laying" which appeared in the issue of the "Electrician" for the 30th ult., and by some editorial comments. The latter show that the explosion trouble continues, and seriously so, to be experienced. Only recently on the mains of one of the London Electricity Companies, an explosive gas was given off by the bituminous composition surrounding the cables, when faults were burnt out; and this gas even spread to the surface boxes of another company, and caused explosions in them. A similar case happened in Bermondsey last month—an explosion occurring some distance away from the actual short-circuit which was the prime cause of the mishap. The editor points out that this effect may be almost eliminated by greatly reducing the unoccupied space in the boxes. In the case of Bermondsey, however, it is believed the gas travelled through some spare ducts which had been laid as provision for extensions. We do not deny that occasionally coal gas may have been partly the cause of explosions in electric lighting systems; but there was a lot of hypothesis about them, as is proved by the simple question, If then, why not now? The electricians, of course, can hardly decline at this time of day to bear their share of the blame in face of ascertained facts.

The Abuse of Trade Unionism.

While the Trade Unions are busy suggesting more or less impracticable remedies for the present deplorable lack of employment, they do not ask themselves how far they may be responsible for the existing state of affairs. Probably they are of opinion that such an investigation would be of no practical use just at this juncture. If so, they are quite right. But there is also the future to consider; and in this connection a review of the past must be of the utmost value. Certain it is that the overstepping by the Unions of their legitimate bounds has had a prejudicial effect on the country's manufacturing operations; and this renders the present an opportune time for pointing the moral. Working men would be less likely to heed a warning when work was brisk and the talk was solely of higher wages and extended privileges. Some useful purpose may therefore be served by a letter which has lately appeared in the "Pall Mall Gazette," on the abuse of Trade Unionism. After admitting the success of the efforts of the Unions to raise wages, the writer regrets that they did not stop there, instead of proceeding to a course of dictation to the employers which has borne the fruits that might have been expected of it. This is very much what has been said in the "JOURNAL" many times before, when we have lamented the disastrous effects on business of the ever-present fear (if not the actual occurrence) of paralyzing strikes. The writer of the letter points out that in the iron and steel trades this liability to hostile action by the Unions has been very marked, to which may reasonably be attributed the great increase of "dumping" by foreign countries. "To the master," he says, "it is a matter of positive gain to obtain from abroad those materials which absolve him from the necessity of having recourse to home labour, with all the liability to strikes and disturbances which it involves. His profits remain the same, and probably larger; but to the men the process is fatal." We have no desire to deal with the political aspect of the question; but if with the return of good times there should be a revival of the aggressive Trade Unionism of a few years ago, working men may perhaps call this statement to mind, and, profiting by past experience, refuse to jeopardize their own livelihood by supporting senseless strikes and unreasonable demands.

The Case of Bethesda.

To show the results of the estrangement between masters and men that has arisen through the excessive use by the latter of their powers of combination, the author of the letter mentioned above quotes an advertisement issued by the Bethesda Pensions Committee. The facts of this memorable struggle are no doubt still fresh in the minds of our readers. The wanton attack that was then made upon a just employer failed in course of time as, against such a man, it was bound to do; and ultimately the vanquished were only too thankful to return to the work that they need never have left. But not all of them were fortunate enough to do this; and it is to those that remained out in the cold that the advertisement refers: "A fund is being raised for the old Bethesda quarrymen who at the conclusion of the late strike found themselves refused admission to Penrhyn Quarry. Some have been employed by Lord Penrhyn for over half-a-century, and are now too old to work. During that time, they made provision for their old age by subscribing to the Penrhyn Quarries Sick and Benefit Club. That Club is dead, however—killed by the strike; and these old men are now faced by destitution. Unless this effort to save them is successful, they must close their lives in the workhouse." Trade Unionists who are troubled with short memories should keep this advertisement before them, so that they may not forget the fate that has overtaken these unhappy men. A system of labour organization that rendered such a strike as that at Lord Penrhyn's quarries possible cannot be in the best interests of working men, whatever may be its proportion of responsibility for the present want of employment.

Local Authorities and Small Loans.

The idea that has been seized upon by local authorities of "raising the wind" by the acceptance of small loans of £10 and upwards, either on deposit or on mortgage, does not appear to have met with the success that might have been imagined from the vast amount of publicity which has been accorded to it. Questions on the subject have been put to about a hundred boroughs by Mr. R. W. Buxton, the Borough Treasurer of Bury, who has been inquiring into the matter on the instructions of his Finance Committee; and as a result he finds that nineteen of them have carried out the arrangement of accepting loans of from £10 to £90. They have, however, with one or two exceptions, met with a very poor response; and in some cases absolute failure has been experienced. Eight more have still the subject under consideration; while the others have not entertained the idea—several of them stating that they do not regard the system as a suitable one for corporations. Bolton has met with some success—a sum of about £50,000 having been raised in amounts of not less than £20 on deposit, at from 3 to 3¼ per cent.; but there is a good deal of trouble involved in the operation of the system. The Treasurer furnishes the depositor with a banker's ticket; the bank accept

the money and hand the depositor a receipt; and the depositor hands the receipt to the Town Clerk, who thereupon issues a deposit note under a sixpenny stamp. Even this, however, does not exhaust the worry, for the Inland Revenue authorities are claiming that a further stamp duty of 2s. 6d. per cent. is due to the Government on this issue; and though the Corporation are resisting it, Mr. Burton says there is every probability that they will have to pay. Less happy have been the Corporation of Stoke, who were desirous of raising £30,000, at 3 per cent., in sums of £10 and multiples thereof. Pamphlets were issued, Press notices secured, and every facility given to make the investment easy; and yet only about £1100 has been received. Birmingham a few years ago raised a large sum by means of loans of £20 and upwards; but so much extra labour was involved that the Corporation have since abandoned the scheme. The Bury Corporation themselves, too, some thirty years ago adopted a like plan; but the result was considered so unsatisfactory that the minimum amount was shortly afterwards raised to £100.

The Municipal Savings Bank.

Mr. Buxton points out that the establishment of a municipal savings bank would necessitate an Act of Parliament and the creation of an entirely separate department with an additional staff; and in view of the facilities already offered for the saving of small sums, he thinks it is extremely doubtful whether such a system could be worked to advantage by a corporation. The acceptance of small deposits entails repayment by small amounts, which would have the effect of doubling the additional labour consequent upon receiving small sums; and the result of his inquiries is that, in order to raise a clear sum of £10,000, the Corporation would have to turn over at least £30,000—stamp duty being payable on the larger amount. This, however, is not all, for attention is drawn to the by no means inconsiderable risk of misappropriation which would be incurred unless a staff of efficient auditors was continually on the premises. Then another matter to be taken into account is the fact that some of the joint-stock banks have arranged to receive across their counters sums as small as a shilling, offering the ordinary bank rate on them, which would no doubt tend to still further minimize the prospects of success by local authorities in the direction named. Under all these circumstances, it is not to be wondered at that Mr. Buxton should give it as his decided opinion that the raising of money in this way is unsuitable to a corporation. He, however, draws attention to a method which has been adopted at Manchester, Preston, Leeds, and other large towns for securing funds by the aid of existing savings banks. By the Savings Bank Act, 1904, the trustees of these banks are empowered to invest with corporations accumulated funds at a small rate of interest above the amount paid to the depositors—thus securing for the authorities loans at a much less rate than they are at present paying, and at considerably less cost than would be involved in running municipal savings banks. The Bury Savings Bank propose to adopt the Act; and Mr. Buxton is naturally hopeful that when they have done so their spare cash will flow freely into the coffers of his Corporation. His outspoken report may be commended to the attention of others besides the Bury Finance Committee.

The Rand Water Arbitration.

Reference has been made at various times in our columns to the arbitration proceedings instituted to determine the amount to be paid by the Rand Water Board for the undertakings it will acquire under an ordinance passed last session by the Legislative Council, in which three Companies are concerned. The Arbitration Court, which was presided over by Mr. Worsley Taylor, K.C., has just made its award, the details of which have been sent to "The Times" by their Johannesburg Correspondent. The Water Company claimed £4,299,900, and they are awarded £1,281,185; the Vierfontein Syndicate, who claimed £546,805, are awarded £477,754; and the Braamfontein Company, who wanted £160,875, are given £45,450. It is estimated that the other liabilities devolving on the Board will bring up to £2,224,000 the total amount paid for expropriation. This figure, it is thought, should allow the present water-rate to the ordinary consumer to be reduced from 10s to 5s. per 1000 gallons within a reasonable period, while still providing interest on the sinking fund for the necessary loan. As there are debentures to the amount of £250,000, the return to the shareholders will apparently be about 1¾ per share, after allowing for liquidation expenses. The inquiry occupied some two months.

THE PROPOSED INSTITUTION OF GAS-WORKS CONTRACTORS AND MANUFACTURERS.

Conformably with the resolution passed at the meeting of the exhibitors at Earl's Court on the last day of the exhibition, gas plant, apparatus, and fittings manufacturers throughout the country will be shortly receiving from Mr. Charles Clare, the Chairman of the Exhibitors' Committee, an invitation to a meeting in February to further discuss and consider the question of forming an Institution of Gas-Works Contractors and Manufacturers. The article which contained the original proposition appeared in the "Journal" for Dec. 6; and there were additional references in the two succeeding numbers. In view of the approaching conference (at which, it may be expected, the question will be fully debated, and agreement be arrived at as to whether or not progress should be made in the matter), it may be helpful to lay before those interested some information as to the objects and work of organizations of a somewhat kindred character. To find organizations already well established, we have not had to carry our search farther than the sister industry of electricity; and it is rather a curious comment on the present position that in an industry which has had, compared with the gas industry, a comparatively short life, there should already be in flourishing existence two Associations, whose respective memberships are composed of the manufacturers and contractors supplying and working for and with those whose especial business it is to generate and distribute electricity. Old, however, as the gas industry is, the question of a special organization for its manufacturers and contractors has never before, so far as we are aware, been mooted or even raised. The Electrical Associations to which reference is going to be made in this article may not be on all-fours with what is proposed in connection with the gas industry; but they will well serve the purpose of illustration and foundation. We do not propose to discuss their aims and objects; but merely to give an outline of them in order to guide, or furnish with material for consideration, those who are interested in the subject of the suggested new Institution. For the information which is here given, acknowledgment must be made of our indebtedness to Mr. R. Tweedy Smith (of Messrs. Turner and Co.), the Hon. Solicitor of the Electrical Contractors' Association, and to Mr. Walter Davenport, the Secretary of the Electrical Manufacturers' Association. Why, by-the-by, there should be two organizations of this kind in the electrical industry, whose interests must be to a large extent homogeneous, is not clear. One would have imagined that there would have been mutual advantage in incorporation in one organization. But, of course, the members know their own business best, though we hope that those who represent the several branches of the gas industry's trade will, if organization is resolved upon, place themselves under one roof and one Council, though it may be advisable to have sectional representation on the latter.

Of the Electrical Contractors' and Manufacturers' Associations, the former must be noticed first, in view of the facts that they have the largest membership—some 300 in all—and are already incorporated; while the Manufacturers' Association are now passing through the stages which will end in their emerging as a chartered body. It is clear that Mr. Tweedy Smith has made an extensive study of the needs of organizations of this description; and the work that he has done for the Electrical Contractors' Association has had a far-reaching effect in providing it with what above all things is requisite—that is, a sound foundation. The Association was formed in 1901; and it was incorporated in September, 1904, and is now a legally constituted body. Its objects are of a character that might well form a working base in the establishment of an Institution of Gas-Works Contractors and Manufacturers. They are—

1.—To improve and elevate the technical and general knowledge of persons engaged in electrical and engineering trade, and protect their interest.
2.—To originate and promote improvements, support or oppose alterations in the law, and to effect improvements in the administration of the same.
3.—To petition Parliament, and take such steps and proceedings as may be necessary in the interest of its members and of the profession generally.
4.—To provide for the delivery of lectures, the holding of classes, and to test by examination or otherwise the competence of such persons.
5.—To award certificates and distinctions, to institute and establish scholarships, grants and awards.
6.—To promote excellence in electrical work, just and honourable practice in the conduct of business, and to suppress malpractice.
7.—To establish a library and collection of models, designs, and drawings, and other articles of interest in the profession.
8.—To promote the adoption of equitable forms of contract and documents.
9.—To encourage the settlement of disputes by arbitration, to act as arbitrators (or nominate same) and umpires, &c., &c.

The organization is divided into sections and local branches; and its membership is composed of three classes—fellows, members, and associates. Applications for membership have to be

endorsed by three fellows or members, who attest that they believe the applicant, "from personal knowledge, to be professionally qualified, and a fit and proper person to be admitted." The entrance fee for members and fellows is £2 2s, and for associates £1 1s.; while the annual subscription for all classes is £2 2s. In addition to the annual meetings, sectional and branch meetings are held, at which the objects of the Association are prosecuted. We have before us now, an address prepared by Mr. Tweedy Smith (and read in his absence) for a meeting of members in Manchester on Nov. 24 last. The subject of that address was "The Work and Aim of the Association." Then at a meeting of members on the 10th inst., a paper was read by Mr. Frank Suter on "The Workman and his Wages." The organization has also been very active in Parliament in opposing the granting of free-wiring powers to municipalities; and they will be represented at Westminster again in the coming session with the same object, particularly on the London County Council Bill. It shows there is a recognized sphere of usefulness for such organizations, that this one, after only two to three years' existence, should decide, and carry through the decision at some expense, to give to the organization the status that is conferred by incorporation. Speaking of expense in this matter, Mr. Tweedy Smith says that, after some experience, he should strongly advise a new Association to immediately form a reserve fund for this purpose; so that, when incorporation is determined upon, the cost involved would not be such a serious matter as otherwise it is if the Association do not happen to be in particularly affluent circumstances at the start.

Mr. Walter Davenport, the Secretary of the National Electrical Manufacturers' Association, though not personally interested in any way in the electrical industry, is undoubtedly one of the moving spirits in this organization; and his independence is rather an advantage than otherwise in the conduct of the administrative work. He is keenly alive to the value of association of men in all spheres of industrial life. In an unincorporated state, the organization has been in existence for two years or thereabouts; and the Memorandum and Articles of Association which will result in incorporation are now before the Board of Trade. The objects of the incorporated body are set out in the Memorandum at considerable length; but it will suffice to epitomize the chief ones as follows:—

1.—To promote and protect the interests of electrical manufacturers.

2.—To promote the consideration and discussion of all questions affecting the electrical manufacturing trade, and generally to watch over and protect the interests of persons engaged in electrical manufacturing.

3.—To give the Legislature and public bodies and others facilities of conferring with, and ascertaining the views of, persons engaged in the electrical manufacturing trades as regards matters directly or indirectly affecting that trade.

4.—To confer with Government, municipal and local authorities, and public bodies generally, in regard to all matters affecting the electrical manufacturing trade.

5.—To originate and promote improvements in the law, and to support or oppose alterations therein, and to effect improvements in administration.

6.—To diffuse among its members information on all matters affecting the electrical manufacturing trade.

7.—To provide for, and be a central medium of useful or confidential information available for every member of the Association.

8.—To obtain more favourable terms and rates from railway companies and shipping companies, and other carriers for the conveyance of goods.

9.—To promote just and honourable practice in the conduct of business, and to suppress malpractice.

10.—To arrange and promote the adoption of equitable forms of contracts and other documents used in the electrical manufacturing trade, and to encourage the settlement of disputes by arbitration, and to act as, or nominate, arbitrators and umpires on such terms and in such cases as may seem expedient.

11.—To promote creditable displays of British electrical machinery, appliances, and fittings, and drawings of the same, at great national and international exhibitions, and to select jurors and reporters who command the confidence of exhibitors.

12.—To establish, subsidize, promote, or co-operate with any Associations with objects similar to those of the Association and not being a trade union.

13.—To establish, administer, and contribute to any charitable or benevolent fund.

14.—To provide facilities for social intercourse between the Members of the Association and their friends.

15.—It is also provided by the Memorandum that the Association shall not impose on its members or support with its funds or otherwise, or attempt to procure, the observance by the members of any regulation or restriction which, if an object of the Association, would make it a trade union.

These are only a few points picked from the Memorandum of the Association, and do not completely represent any one clause, nor indicate the composition of the Memorandum in its entirety. But the statement is sufficient to show the wide range of the capacity of the organization for good and effective work; and, taken in conjunction with the objects set forth above of the Contractors' Association, should enable a very good programme of usefulness to be constructed for an Institution of Gas-Works Contractors and Manufacturers. The membership of the Incorporated Electrical Manufacturers' Association is to be divided into three classes—members, associate members, and associates. The first are to be electrical manufacturers engaged in carrying on business in the United Kingdom as electrical manufacturers, employing workmen, providing both labour and materials, and coming under the provisions of the Factory Act. The associate member class is only to provide for those persons or firms who were members of the unincorporated Association, but who are not qualified to become members of the incorporated one by the Articles of Association. The class of associates is for persons or firms engaged in supplying or handling electrical goods, either as principals or agents, but not having works carried on under the provisions of the Factory Act. Agents must be persons or firms trading on his or their own account in the United Kingdom. The entrance fee for membership, unless altered by general meeting, is to be £5 5s., and for associates £3 3s. The annual subscriptions are to be of similar amount, unless otherwise determined in general meeting. Associates are not to be entitled to a vote. The annual general meetings are to be held in London in January or February each year.

Mr. Davenport points out that the organization of such bodies, if any permanent good is to result, absorbs a great deal of time, and the expenditure of much trouble. But what the electrical contractors and manufacturers have done, that surely the contractors and manufacturers of the gas industry can do. He also advises that from the first stages of the promotion and afterwards, the right type of men must be identified with the work of administration—men who enter into the work for the love of the thing and not for personal interest, and men who will have the confidence not only of the members, but of all outside the organization who may be influenced by, or brought into touch with, its operations. Another very important matter is that, from the start, a Secretary should be appointed with suitable qualifications for the post, and one who can exercise influence among, and win the respect of, the members. The Council, too, must, by firm ruling, prevent the Association becoming the airing-ground for members' crotchets. Another piece of advice is that it should be an indispensable condition that the class of members should be confined to responsible men—men who can vote and speak for their firms directly, when occasion requires, at meetings. The Electrical Manufacturers' Association, he tells us, are well recognized by other Associations and technical bodies. They are, for example, represented by two members on the Electrical Standards Committee; and they are specially well qualified to assist in investigations. All of which is sound counsel and encouraging to those who are considering the question of forming an Institution for the contractors and manufacturers of the gas industry. "As a body any class of men are more powerful in any work than as individuals." Those were among the words that Mr. Davenport used in bringing to a close an interesting conversation had with him on this matter last week. The information gathered from him and Mr. Tweedy Smith, we trust, will be of assistance at the second conference on the important question of whether gas-works contractors and manufacturers are to have an Institution worthy of them to co-operate in the present great work of the gas industry, and the still greater work which lies before it.

Recent Developments of Gas Lighting.

In the January number of "Technics," Mr. Thomas Holgate, M.Inst.C.E., commences the first of what is evidently to be a series of articles, entitled "Recent Developments of Gas Lighting." The forms of lighting described were among those on view at the Earl's Court Exhibition, and comprise certain of the high-pressure systems (the "Sale-Onslow," the "Millennium," the "Pharos," and the Air Light Company's); the "Podmore" recuperative lamp; the "Star," Darwin, and "Globe" patterns of inverted lights; the "Witt Underlight" burner; the "Hanwell" pendant; and Gunning's system of lighting and extinguishing. As will be seen from this list, Mr. Holgate has not by any means exhausted the competing systems; and, unless the deficiency is to be made good in the succeeding articles, one can hardly see what line he has adopted in making his selection for description and illustration. If the present examples are to be supplemented in succeeding articles, then we submit that it would have been preferable to have completed each class of lighting in a single group, as this would have given greater general value to the compilation. The heading to the article, too, might perhaps have been a little more comprehensive than "Recent Developments of Gas Lighting," so as to have covered what will not be expected by the reader in an article titled as this one is—a description of the "Rotary" meter, Messrs. Rotherham and Sons' change-giving mechanism for prepayment meters, Messrs. S. Cutler and Sons' "Ados" carbonic acid recorder, and the "Rotary" Meter Syndicate's carbonic acid indicator. However, Mr. Holgate has clearly and pithily described the actions by which the various lighting and other arrangements succeed in attaining the object of their inventors. The article (and no doubt those which will follow) will be of great use in cultivating a knowledge of these things among that portion of the public who find interest in a magazine whose special mission is "to aid technical progress."

THE JUBILEE OF MR. LEONARD KÖRTING.

On the 1st of January, 1855, Mr. Leonard Körting (well known in this country as the Engineer and Manager of the Hanover station of the Imperial Continental Gas Association) entered the service of that huge organization; and consequently his fiftieth anniversary was on the first day of this year. Such an event is celebrated in the German Fatherland with all the circumstance that friends and neighbours can devise. Everybody seems anxious and willing to do something to show his or her regard, and treats the occasion as one for manifesting, in one way or another, superlative joy. In this instance—and it is an instance in which we are greatly interested through personal friendship—Mr. Körting was, on New Year's Day, the recipient of hundreds of congratulatory telegrams and letters from all parts of the Continent and from England. In the evening, a supper was given by him, to which the employees of the Association and their friends, to the number of 1400, sat down. One of the events of the evening was the presentation by the men to Mr. Körting of a beautiful carved cabinet, as a token of their respect and affection. Exhibitions of gymnastics and club-swinging were also given by employees, and songs befitting the occasion were sung by the club (one of which exists in most large establishments in Germany). The first verse of one of the songs was—

Stosst an, I.C.G.A. lebe, hurrah hoch!
Wo über'n Kanal vom Themsestrand
Hannover und London sich reichen die Hand
Für unser Werk!

This may be freely translated:

Long life to the I.C.G.A., hurrah!
Where across the Channel from the shores of Thames
Hanover and London join hands
For our work.

This looks and sounds a great deal better in German than in English; but it is put in just to show the warmth of feeling that existed on this occasion. The workmen were enthusiastic for Mr. Körting, who has ever proved most sympathetic both to them and their families. A torchlight procession had also been arranged for that evening; but, owing to the storm which prevailed at the time, it had to be postponed until the Saturday evening.

On the night of Friday, the 6th inst., Mr. J. Horsley Palmer, the Chairman of the Association, undaunted by the raging gale, proceeded to Hanover, where he arrived on the Saturday afternoon, and witnessed the torchlight procession. This was splendidly organized, and proved very imposing. All the different classes of employees bore significant emblems—for instance, the stokers carried scoops, the mainlayers mains, and some of the clerical staff bore huge quill pens and inkpots. There were also two cars—one representing a retort-house with men charging a retort, and the other bearing a gas-cooking apparatus, on which were transparencies with the mottoes "Koche mit Gas" (cook by gas) and "Bade zu Hause" (take your bath at home). Accompanied by several bands of music, and an enormous crowd of sightseers, the procession made its way to the gas-works, where it drew up in the yard, and several speeches were delivered by the men, and replied to by Mr. Körting, who was visibly affected. Mr. Horsley Palmer took the opportunity of addressing a few stirring words to the men, in which he referred to the Directors' sympathy with them, and to the foundation, by the Association, of the workmen's pension and sick funds.

On the morning of Sunday, the 8th inst., Mr. Körting also had a busy time. First Mr. Palmer, on behalf of the Directors of the Association, with a few kind words, presented him with a gold chronometer, on which was engraved—

Presented to LEONARD KORTING, Esq., Manager at Hanover, by the Board of the IMPERIAL CONTINENTAL GAS ASSOCIATION, in grateful recognition of Fifty Years' Valuable Services rendered by him to the Association, 1st January, 1905.

It may be incidentally mentioned that this is the fifth occasion on which the Directors have presented a gold watch to an employee who has completed fifty years' service with the Association. The previous occasions were: In 1892, to Mr. L. G. Drory (1842-96), Chief Engineer at Berlin; in 1892, to Mr. A. Dudeum (1842-92), Chief Accountant at Vienna; in 1893, to Mr. J. Walton (1843-97), Accountant in the London Office; and in 1903, to Mr. W. W. Drory, Chief Engineer at Frankfort, who entered the service in 1853.

Several of Mr. Körting's colleagues were present from other stations—viz., Mr. J. Drory from Aix-la-Chapelle, Mr. Brender à Brandis from Antwerp, Mr. H. Salomons from Brussels, Mr. E. Körting from Berlin, Mr. W. W. Drory from Frankfort-on-Main, Mr. Anderson of Hanover, and Mr. Pohmer from Berlin—and they presented him with an elaborate silver tea and coffee service and an album with the photographs of the subscribers. The presentation was made by Mr. Salomons.

On Sunday evening the celebration was brought to a close by a dinner given by the Association in Mr. Körting's honour, at which many notabilities of the town were present—among others being Landesdirektor Lichtenberg, Regierungs u. Gewerberat von Rosnowski, Stadtdirektor Tramm, Syndicus Eyl, Stadtbaurat Wolff; the Burgomaster of Linden (Mr. Lodemann); the Technical High School was represented by His Magnificence Geheimer Regierungs and Baurat Barkhausen (the Rector); from the German Association of Gas and Water Engineers were Herr von Oechelhäuser and Direktor Kohn, together with the colleagues and personal friends of Mr. Körting—some 60 persons in all.

The numerous toasts were, in accordance with German custom, interspersed between the courses; the first, which was proposed by Mr. Horsley Palmer, being "The Health of the German Emperor." This was followed by "The Health of the King of England;" being given by Landesdirektor Lichtenberg. Needless to say, both toasts were most enthusiastically received. After a few words of hearty welcome by the Chairman, he proposed the toast of the evening. In a most eloquent speech, Mr. Palmer referred, in eulogistic terms, to the services rendered by the guest of the evening during his fifty years' service with the Imperial Continental Gas Association. Mr. Körting, in reply, thanked all present for coming to do him honour, and concluded a most interesting speech, full of reminiscence, by wishing further prosperity to the Association. The next toast, proposed by Mr. William Drory, was that of "The Town of Hanover," with which by the way the Association have been connected since 1823. Mr. Drory laid particular stress on the fact that the relations between the town and the Association were of the most cordial nature. It was a gratifying fact that the gentleman who was instrumental in getting the last prolongation of the contract passed through the Town Council, in the face of great opposition, was present that evening. Stadtdirektor Tramm, in proposing the next toast, "Success to the Association," said that the opposition to the prolongation of the contract was very great at the time; but it was a most pleasurable feeling for him to know now that it was universally acknowledged that the contract had really been to the benefit of the town, and that the most sanguine expectations had been more than realized. He himself was unable to withstand a feeling of bliss every year when, engaged in compiling the estimates, he came to the item, "Receipts from the Gas-Works." It was a great pleasure to have business relations with an Association whose dealings were always free from any narrow-mindedness or pettiness, and whose high-minded and generous trading had conduced to the agreeable relations always existing between the town and the Association. Director Köhn (Frankfort-on-Main) proposed "The Health of the Family of Mr. Körting;" and with the toast of "The Ladies," proposed by Mr. Prücker, the Engineer of the Corporation Electrical Works, the arranged toast-list ended. Several speeches were, however, made—notably, one by Herr von Oechelhäuser, the Managing-Director of the German Continental Gas Company, who referred to the cordial relations existing between English and German gas engineers, and to the fact that the Imperial Continental Gas Association was, at the time, the incentive to the formation of the German Company, who had not only copied the name closely, but also the methods of conducting their business. Songs and music contributed not a little to the enjoyment of the evening.

The dinner was a success from beginning to end; and everybody who participated felt that all honour had been paid to a devoted servant, and that such honour had been truly merited.

Formulæ for the Discharge of Pipes.

In connection with the articles bearing upon the above subject recently contributed to our columns by Mr. F. Southwell Cripps, the following particulars, for which we are indebted to the "Engineering Record," will probably prove interesting: "Among the writers on pipe formulæ who may always be counted upon to give useful information is M. Dariès, one of the engineers in the Water Department of the city of Paris. In the 'Nouvelles Annalles de la Construction,' he has lately given a most painstaking comparison of the formulæ proposed by Prony in 1804, Saint-Venant in 1840, Dupuit in 1855, Weisbach in 1860, and Colombo in 1878, representing attempts to express mathematically the discharge of a pipe without taking into account the condition of the walls, and the formulæ proposed by Darcy in 1862, Lévy in 1868, Hagen in 1866, Gauckler in 1873, Flamant in 1892, Geslain in 1899, Franck in 1881, Unwin and Reynolds in 1882, Manning in 1884, Lampe in 1885, Thrupp in 1887, and Kutter in 1869. He has computed the discharge of pipes of 12 diameters, each on seven grades, by eighteen formulæ. The results are presented in a number of tables, and data are also given of the results of gaugings of several mains. The conclusion reached by M. Dariès is that the Flamant formula is preferable for diameters up to 1 metre; while above this size the Lévy formula is preferred. He acknowledges, however, that there are a number of other formulæ which are probably sufficiently accurate for practical use."

Photography by Gaslight.—Interesting results have been obtained, according to the "Bulletin de la Société Française de Photographie," by the employment of incandescent gas-burners for taking portraits in rooms. The burners were fitted with white cardboard reflectors, and according to requirements, a single burner was employed (say) on the left of the sitter, with reflecting screen on the right, or two burners—one on the left and the other on the right. The time of exposure was from 15 to 20 seconds.

THE GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 181.)

THE Stock Exchange has had rather a poor week. But still things were not altogether bad, and there were mild symptoms of a desire to improve, if only they could receive a little encouragement. Almost every day was flat at the opening and better at the close; but the gain of the evening was lost the next morning. Fresh business was on a limited scale; the fortnightly settlement being the chief consideration. So far, it seems to have gone through without insuperable difficulties. In the Money Market, there was a good demand, which steadily stiffened rates until it relaxed with the close of the week. Discount rates were generally a shade easier. In the Gas Market, business thoroughly maintained the degree of activity which has characterized it for some weeks past. The leading issues did not have it all to themselves; there being a fair proportion of transactions in less conspicuous stocks. The general tendency, too, was strong and buoyant; a goodly number of issues advancing their quotations more or less. In Gaslight and Coke securities, the ordinary was as active as ever, if not more so, and soon showed that it was recovering from the slight set-back which the realization of profits in the previous week had inflicted upon it. On the opening day, it changed hands once as low as 101; but on Tuesday it touched 103, and 104¼ the next two days. The quotation showed at one time a gain of a couple of points; but the rate of recovery had been rather overdone, and half a point had to come off it. The secured issues were fairly brisk. The maximum changed hands at from 93 to 94, and the preference from 109½ to 111—the quotation of the latter advancing a point. The debenture marked 88 and 88½. South Metropolitan was strong and active, and promptly scored the advance which might have been made the preceding week. Stock changed hands at from 133 to 134¼; and the debenture marked 90. Commercials were more active at good figures. The 4 per cent. was done at from 118¼ to 120; the 3½ per cent. from 113⅜ to 114⅜; and the debenture at 85½. The Suburban group showed more activity; and several issues improved their figures. Brentford old marked 252 and 255, and ditto new 193. British was done several times at from 40⅜ to 41½. Bromley "B" marked 93½ and 94. Both Brightons advanced without business being done. South Suburban realized 123½, ditto preference 126, and ditto debenture 134. West Ham marked 100⅛ and 101¼, and ditto preference 123½. The Continental Companies were quiet and firm. Prices of Imperial ranged from 211½ to 213½, Union marked 117⅜ and 118, and ditto preference 142. Among the remoter Gas undertakings, Bombay new was done at 4¾, and a small parcel of Oriental at 147½ "free." Buenos Ayres marked 11½ and 11⅝, River Plate 12, and ditto debenture 95 and 95¾. San Paulo was done at 12 1/16 and 12 7/16. Primitiva ordinary realized 5 9/16 and 5⅝, ditto preference 4 15/16, ditto debenture 94⅞ and 95. Cape Town ordinary marked 16⅝, ditto preference 9⅝.

The closing quotations are shown, as usual, in our stock and share list, p. 181.

ELECTRIC LIGHTING MEMORANDA.

Photometry of Electric Incandescent Lights—The Question of a Standard—Joint Opposition to the London Electricity Bills.

WE have often regretted that the subject of the photometry of electric lighting has not been taken more seriously in hand by electricians; but the reason for their indifference to it is no doubt in a measure found in the fact that, contrary to those interested in the much-manacled gas supply, they have no compulsory interest in such things as standard illuminating powers and penalties for default. Consequently, there has in the past been something rather haphazard about the way they have rated the illumination that lamps are supposed to give and the consumers to receive. An electric incandescent lamp is called 8, 16, or 32 candle power as the case may be; but, to get one or other of these candle powers, certain conditions have to be observed and preserved, and those conditions are far from being constant. Moreover, the lamps themselves, even under constant conditions, have an unpleasant knack of deteriorating; so that one, from experience, considerably mistrusts the illuminating powers accorded to these lamps by electricians and vendors. However, there are indications that photometry is gaining interest for our electrical friends; and the sooner its practice becomes general on an acceptable basis, the better, and the more interesting will become the competition between the rival lights. But the electricians are apparently finding some difficulty in arriving at a generally acceptable basis; and that, it seems, is one of the "disadvantages" of not having everything nicely prescribed for the purpose, and set out in Acts of Parliament and regulations. We have been very much interested in an article on the subject of "Photometry for Central Station Engineers," by Mr. Lancelot W. Wild, in the "Electrical Review," in which article it is confessed that the apparatus hitherto employed for making photometric tests of electric incandescent lamps has not generally been the most suitable for the purpose. Mr. Wild, however, proposes what can only be described as a rough-and-ready method of testing. That is the kind of thing that in photometry we deprecate, and that is one ground of our refusal to recognize the readings made by the portable photometer. If tests are to be of any value, are to be accounted reliable, and are to be comparative, and capable of repetition, they must be scientifically accurate in every respect.

Mr. Wild does not regard the Harcourt 10-candle power pentane lamp as a practical standard except in the hands of a specially skilled operator; and he recommends, for general testing work, and as being the "best" working standard, an electric incandescent lamp, the standardization of which with the Harcourt pentane lamp, he suggests, can be left in the hands of the Institutions making a speciality of such work. Even then the pitfalls in the way of accuracy are too many for our liking. It will be necessary to provide the means for maintaining a very steady voltage at the lamp terminals, as well as means for measuring that voltage with a very high degree of accuracy, if absolute candle power measurements are to be made. Much, too, will depend upon the lamp itself. If it is anything like most of its contemporaries, it will need frequent verification with the Harcourt 10-candle pentane lamp to see that deterioration has not caused a serious deflection from the path of truth. Besides, Mr. Wild himself admits other possible sources of mistake. The lamp should have a clean, well-fitting cap, or otherwise errors will occur owing to bad contacts. A lamp should be chosen that can be turned through an angle of (say) 15° without the candle power varying more than 2 per cent.; otherwise errors may occur, due to the lamp being badly centred when in position. The lamp, too, should be run at normal voltage, for from 200 to 500 hours, before being standardized, as it will not otherwise maintain its candle power for any length of time without showing considerable variation. Well, now, after all this, what confidence can anyone have in an electric incandescent lamp being accepted as a standard; and, furthermore, what confidence can ordinary users have in electric incandescent lamps if all these precautions have to be satisfied to keep even to an approximate standard of illuminating power? To use an electric incandescent lamp as a standard, we are afraid that tests could only be regarded as correct, by making the Harcourt 10-candle pentane lamp an integral part of the equipment, and adopting the methods proposed by Messrs. Carpenter and Helps for testing incandescent gas-burners. This would enable the electric incandescent standard to be verified before making readings that were required for any other purpose than personal satisfaction. It is surprising that, in a profession in which Science plays so important a part, anything but what is absolutely above suspicion should be suggested for ascertaining light values; and it is equally astonishing to learn that a lamp that is in use in many gas-works should be held by an electrician to be "hardly a practical standard, except in the hands of a specially skilled operator." It is interesting to remark that Mr. Wild's opinion is that the best form of comparison-box is the Simmance-Abady "Flicker" photometer.

The overwhelming schemes for electricity supply in London (which, in all conscience, is already electrified sufficiently) proposed to be brought before Parliament in the approaching session are to encounter something like combined opposition on the part of several of the Borough Councils, aided probably by a district authority or two in the environs. That the Borough Councils who are in possession of electricity supply works, or who have in their respective areas a company controlled undertaking in which they have the interest of possible prospective owners, should object to their districts being overrun by power competitors is not surprising. From 21 of the Councils, delegates attended at the Shoreditch Town Hall last Wednesday, to consider the question of opposition to the group of London Bills; but the result was not of a very definite order. Caution was the paramount feature of the proceedings; the delegates having some amount of scruple in going too far in committing their Councils to action. Of course, the latter have not the power to spend money in opposing Bills that do not concern their particular locality; and so it was impossible to pledge them to any subsidizing of united action against the whole of the measures. The only length to which the delegates felt themselves at liberty to go was to express the view that it was "desirable" the Councils should jointly oppose the Bills affecting their boroughs. Another step was taken in the appointment of an Executive Committee to conduct the joint opposition; and—but this was also subject to the approval of the respective Councils—to arrange for the necessary petitions, with power to engage Parliamentary Agents, Counsel, and witnesses. There was a peculiar proposal, however, the passing of which would have put the Councils practically out of Court, to the effect that the Executive Committee should consider the advisability of formulating a municipal scheme for a large generating station for the supply of electricity in bulk to existing municipal undertakings. The danger of any favourable expression of opinion on the point by the meeting was at once recognized; and the proposal was dropped without even a vote being taken. The Supply of Electricity Bill was also included in the measures meriting joint opposition. But a suggestion that the London Gas Bills should also be roped in with the others was ruled out of order. The Councils will undoubtedly have quite enough to do in confining attention to the Electricity Bills, and may well be advised to leave the Gas Bills alone.

THE PREPAYMENT METER BRANCH.

Experience at Tottenham.

It has before been remarked that the suburbs of London on the east side form a particularly interesting study in respect of their gas supply, inasmuch as the working and middle classes have been of late years congregating more thickly, and spreading themselves farther afield, in that direction than in the north, south, or west. What has been the effect upon the gas supply of this migration to, and settlement in, those parts? The answer is that there have been year after year general increases of consumption on a percentage scale that we do not think has been surpassed by any other district of the country. This shows that the working and middle class people are very desirable customers for a gas undertaking. But, of course, the increment of consumption in such districts would not have been at such a large and rapid rate if it had not been for the prepayment meter; and therefore while nearly all gas undertakings have to be thankful for the advent of that meter, it is in districts thickly populated by working class people that the gas suppliers have cause to be especially so. The "load" per mile of main, whether measured by the number of connections or by the consumption of gas, has, through this system, assumed a far different aspect.

Let us take the Tottenham and Edmonton Gas Company as an example. The Company's officials are very proud of what they have done in connection with the prepayment system; and the completion by Mr. James Randall (who has seen some changes in this Company since he first entered its service, and not the least remarkable one has been this development in the prepaid service) of his records for last year, shows that the increase, far from presenting any signs of abatement, is going on as vigorously, and more so, as in the best of previous years. In fact, though the percentage increase in consumers is not so high by 3·38 as in the previous year, the total increase has never before been approached. In other words, the previous record increase for a year was 3437 in 1903; and this compares with 3899 in 1904. The total number of the prepayment consumers last Christmas was 19,349, as against 15,540—showing the increase of 3899, or 25·23 per cent. The consumption of gas through the prepayment meters yielded an increase equal to no less than 22·17 per cent.—the total amount registered being 220,851,300 cubic feet, as compared with 180,772,100 cubic feet in 1903, or an addition of 40,079,200 cubic feet. This is excellent. It is observed that during the year gas was sold through the prepayment meters (including the extra charge) at 2d. less than in 1903—that is to say at 3s. 7½d. per 1000 cubic feet (or 23 cubic feet for a penny), as against in 1903 3s. 9½d. per 1000 cubic feet (or 22 cubic feet for a penny). In the year the cash collected from the meters amounted to £40,009 5s., as compared with £34,237 2s. 10d. in 1903—the increase being £5772, or not far short of 17 per cent., or as Mr. Randall—with his care for extreme nicety in the matter of figures—renders it £16 17s. 2·20d. per cent.

Set out in tabular form, we are able to see at a glance the rate of progress in this one suburban district during latter years.

Xmas.	Consumers.	Increase.	Per Cent.
1898 ..	7,024 ..	— ..	—
1899 ..	8,082 ..	1,058 ..	15·06
1900 ..	9,048 ..	966 ..	11·95
1901 ..	9,619 ..	571 ..	6·31
1902 ..	12,013 ..	2,394 ..	24·88
1903 ..	15,450 ..	3,437 ..	28·61
1904 ..	19,349 ..	3,899 ..	25·23

Or an increase in six years of 175·46 per cent.

It ought to be stated, as being matters to the credit of the past year's working, and influencing somewhat the figures, that the last quarter was some four days shorter for the returns than the Christmas quarter of 1903—due to more collectors having been employed, with, consequently, a more expeditious completion of the work. The cash totals in the ledgers were also balanced ten days earlier than at any previous quarter.

Electricity Connections in London.—The "Electrician" last week published a diagram illustrating the progress made by some of the London electricity supply undertakings during the past year. It is interesting to observe that the total connections in London are equivalent to about 6·8 millions of 8-candle power lamps; this figure showing an increase of 1·3 millions over that of the previous year. There is thus more than one 8-candle power lamp per head of population. Still gas prospers.

The Outlook in the Coal Trade.—In closing their summary of the coal trade in the past year, our contemporary the "Colliery Guardian" remarks: "The outlook for the present year is by no means unpromising. The iron trade already shows signs of increased activity; and there is a general impression, that counts for something, that better times are ahead. If this prove true, 1904, as the worst of a cycle, must be recorded as having been by no means so bad as many in the past. The fulfilment of the promise is, however, largely dependent upon a steady development. The enormous increase in national expenditure and, more especially, in local indebtedness, must prove serious obstacles to commerce, unless the most determined efforts are made to remove them or discount their effects."

PERSONAL.

In previous issues of the "Journal" we have recorded the progress made by Mr. C. E. Brackenbury, Assoc.M.Inst.C.E., in his legal studies. We are pleased to notice that at the Hilary examination of the Council of Legal Education he passed in the second class in the subject of "Evidence, Procedure (Civil and Criminal), and Criminal Law." Mr. Brackenbury is a student at the Middle Temple.

Mr. Henry J. Randall, the fourth son of Mr. James Randall, of Tottenham, left England on the 17th ult. for the Cape, to take the position of Superintendent of the Woodstock Station of the Cape Town and District Gas Company. He was educated at the Grocers' Company's School at Hackney, and was articled to, and served five years with, Messrs. S. Cutler and Sons, who entrusted him with the charge of several important jobs in connection with the erection of plant, gasholder, and carburetted water-gas apparatus, at Bournemouth, Tottenham, Mitcham, and elsewhere. He was for some time with Mr. J. L. Chapman at the Harrow Gas-Works. He gained an Honours certificate in the City and Guilds of London examinations in "Gas Manufacture." Before leaving England, he was united in matrimony, at Emmanuel Church, Weston-super-Mare, to Miss Bessie Stacy, second daughter of Mr. D. S. Stacy, of that town, and later in the day they started upon their journey to the Cape, where they arrived safely on the 3rd inst. The heartiest good wishes of the many friends of Mr. James Randall accompanied them.

The first meeting in the New Year of the Board of the Eastbourne Gas Company was marked by an interesting event which testified at once to the salubrity of the town and the good feeling existing among the gentlemen who have the control of its gas supply. On the occasion referred to, Mr. Alderman Farncombe said he had been asked to express the feelings of his co-Directors in welcoming the venerable Chairman (Dr. G. A. Jeffery, J.P.) at their first meeting in 1905, and wishing him a very Happy New Year; and, in anticipation of an event which would occur in a few days, also to wish him many happy returns of his natal day, especially as he was about to become an octogenarian. His colleagues had thought this a suitable occasion on which to place on the walls of their Boardroom a portrait of one who had been for so many years associated with the direction of the Company, and for 45 years the Chairman. Pointing to the portrait, the speaker said they sincerely hoped Dr. Jeffery might look upon his pictorial representation with satisfaction for a long time to come, and his colleagues enjoy the even greater pleasure of seeing the original presiding over their deliberations, as he had done so ably in the past, for many years in the future. As an accompanying picture, they had secured a very excellent representation of their late valued colleague, Mr. Joseph Gorringe, who was a Director of the Company for 34 years. He trusted that this portrait would help to keep green the memory of one who deservedly held a high place in the affections of all with whom he was brought into contact, and who was so much entitled to their esteem. In conclusion, Mr. Farncombe expressed hearty good wishes for the health of Dr. and Mrs. Jeffery and the family, trusting they might enjoy every earthly blessing for many years. The Deputy-Chairman (Mr. J. C. Towner) endorsed these remarks in a few well-chosen sentences. Dr. Jeffery said he appreciated highly the excellent feeling which existed now, as at all times, upon the Board. The compliment paid to him that day was an especially gratifying one; and the terms of congratulation which had been expressed were highly prized by him, as they would be by the other members of his family.

OBITUARY.

At the meeting of the Junior Institution last Friday night, sympathetic mention was made of the death of Mr. L. V. Sapey, of Horsham, who died at Amsterdam just recently. The Council had conveyed a message of condolence with his family in their bereavement. Although he had not quite attained his majority, Mr. Sapey had, by the excellence of his work, shown great promise of rapidly advancing in his engineering career.

We greatly regret to announce the death, under the painful circumstances recorded in another part of the "Journal," of Mr. J. F. Bromley, the Gas Engineer, Manager, and Secretary of the Batley Corporation. Mr. Bromley, who was a Bolton man, took this position about sixteen years ago, and under his management the gas undertaking has been remarkably successful, with the result that it has been able to furnish large sums out of profits in relief of the rates, notwithstanding the low price charged for gas, and the liberal discount allowed for prompt payment of accounts. He was acknowledged on all hands to be a thoroughly able and conscientious public official; and his services were highly valued by the Corporation, whose appreciation of his work was expressed in such a way as to induce him to settle down permanently at Batley among the numerous friends he and his family had made. He joined the Gas Institute as an associate in 1885, when he was at Tong, near Bolton; in 1888 he was transferred to the class of associate members, and in the following year to that

of members. He was also a member of the Manchester District Institution; having been elected at the meeting in Bradford in August, 1889. Mr. Bromley was a man of rather striking personality, good presence, and genial disposition; and by his death the town loses a resident who was held in high esteem. He was 61 years of age; and he leaves a widow, three daughters (one of whom is married), and one son, who was his assistant, for all of whom the keenest sympathy is felt in the severe bereavement they have sustained. Mr. Bromley was an enthusiastic Freemason, and had passed the chair. The funeral took place yesterday afternoon, and was largely attended by members of the Corporation and officials.

One of the oldest residents at Enfield, and a gentleman who formerly took an active interest in local affairs—Mr. James Warren—has recently passed away in his 69th year. The sad event calls for notice in our columns from the fact that the deceased had been a Director of the Tottenham and Edmonton Gas Company for 23 years, and of the Brighton and Hove and East Cowes Gas Companies for 36 years. The Board of the first-named Company passed a resolution recording their deep regret at the loss of their greatly esteemed colleague, and their sincere sympathy with Mrs. Warren and the whole family in the bereavement they had sustained. They added: "Mr. Warren was endeared to all by his amiable disposition; and his devotion to the interests of the Company will cause his name to be long and gratefully remembered." The resolution was duly forwarded to Mrs. Warren. The funeral was largely attended by gentlemen representative not only of the district, but also of the commercial concerns with which the deceased had been associated.

The death of Mr. Thomas Fenwick, of Leeds, early last Tuesday morning, removes from the ranks of civil engineers one who for years held a conspicuous place among them. Though in his 81st year, he was in possession of both mental and physical vigour, and was engaged in professional work up till a few days before his death, when he contracted a cold, which was succeeded by a serious bronchial attack; and he succumbed to heart failure. Mr. Fenwick had had considerable experience in municipal engineering. From 1851 till 1861 he was Borough Surveyor of North Shields and Tynemouth; but in the latter year he joined Mr. S. D. Martin, and commenced practice with him in Leeds. On Mr. Martin's death in 1877, the business was continued by Mr. Fenwick, who took into partnership his two elder sons. In his own sphere, no one was better known in the North of England. Among other positions filled by him was that of Consulting Engineer to the Hartlepool Gas and Water Company; and their recent extensions were carried out under his supervision. He was associated with Mr. J. F. Bateman in reporting upon the water supply of Tynemouth in 1874; and the following year he took an active part in promoting an unsuccessful scheme for the supply of water to East Northumberland. He was well known in Westminster, and last year was one of the witnesses engaged by the Tynemouth Corporation in their opposition to the Newcastle and Gateshead Water Bill. As arbitrator and umpire, he had a wide reputation. He was a member ot the Institution of Civil Engineers and a Fellow of the Surveyors' Institution. In professional as in social life his personal qualities gained him many friends, whose sympathy will be extended to his widow and the members of the family in their bereavement. The interment took place on Friday afternoon in the old churchyard at Chapel-Allerton.

Mr. W. C. Young, F.I.C., F.C.S., has been appointed Borough Analyst to the West Ham Town Council.

"Calorimetry" is the subject of an interesting article contributed by Mr. John F. Simmance to the current number of "Engineering."

It may be remembered that the Denver Gas and Electric Company recently offered prizes for the largest number of words made from letters in the phrase "Genuine Gas Coke." The awards have been made: $50 for the first prize, with 5323 words; $25 for the second, with 5268 words; and $10 for the third, with 4938 words. Prizes were also offered for the best suggestions for making this coke popular in Denver; and five prizes of $5 each were awarded.

The German patent No. 130,112, dated April 28, 1900, and granted to Professor Vivian B. Lewes, for a "Process for Passing Water Gas, &c., through Coal-Gas Retorts," has been the subject of proceedings recently before the Nullity Division of the German Imperial Patent Office. The patent is exploited by the German Water Gas Company (Dellwik-Fleischer System), of Berlin. The upshot of the proceedings is that the patent in question has been declared invalid.

The Engineering Standards Committee have issued their report on a "British Standard Specification for Portland Cement." It is stated in the preface that the Committee on Cement was adpointed on March 27, 1903. The first meeting was held on June 12, 1903, when the Chairman and Mr. Bertram Blount consented to draw up a draft specification for the consideration of the members. The Committee held twelve meetings, and collected a large amount of information from engineers, manufacturers, and consumers of cement, all of which was carefully collated and considered by the Committee. The specification was passed in its final form at a meeting held on Nov. 23, 1904, and the report was approved by the main Committee at their meeting on the 8th ult.

THE TREND OF GAS INVENTION.

An article which had appeared in the "American Gaslight Journal" on "The Profession of Gas Engineering in America" received a fortnight since a little editorial examination in these columns. The author of the article in our contemporary made a somewhat scathing criticism of the indigency of the creative faculty in the gas profession of America, as disclosed by the records of the past; and we were, and still are, inclined to think that the assertions were not particularly helpful to the main purpose (which constituted a rather startling proposition in these progressive days) of his article. However that may be, in making our annual investigation of the gas specifications issued by the Patent Office of this country during the past year, we have certainly been struck by the paucity of the gas inventions for which our American cousins have applied for protection in this country. Prominence is given to this statement in the hope that the last has not been heard of the article to which reference is made, and that the question will be discussed, and their position defended, by our American friends.

Meanwhile it is pleasant to note that, so far as this country and the Continent are concerned, there is no retrogression, as revealed by the patent specifications, in the matter of gas invention. The total number of abstracts of gas specifications which were published in the "Journal" during the past year was 298, of which this country takes credit, with a few from the Colonies, for 162, and the Continent, with a few from America, for 136. This number of 298 is only a dozen less than the total for 1903; and compares with 240 for 1902, and 259 for 1901. The slight falling off from the 310 abstracts published in 1903 is more than accounted for by the fact that many specifications were rejected during the year as being unworthy of notice, and from which it was believed no useful result would accrue in according them publicity in our pages. "Invention" is a term to which (according to many specifications of patents) a very strained interpretation is frequently applied; and, consequently, many specifications come to hand, the puerility of the subject of which borders on, if it does not actually overstep the border of, the humorous. Such as these can only be placed on one side with a passing pitying thought for the men who imagine they have enriched the world, and have found the pathway to their own financial improvement; while as a matter of fact their so-called "patent rights" are not worth the paper that their specification was originally written upon. We permit ourselves this little latitude in the criticism of the gas "patents" which have been left unnoticed during the past year in the belief that, dealing with the essential parts of such numbers of specifications each year—numbering, for example, as the figures already mentioned show, upwards of a thousand in four years only—enables a fair discrimination to be made between those subjects for which protection has been sought that contain at least ingenuity and those that are of negative value.

However, the scrutiny of the year's gas specification publication has shown that, not only in number but in quality, there has of late been no decline; and it is very apparent that activity in every department in which attention is for the time being turned is general in this country and on the Continent. Whether we look to the specifications dealing with the plant engaged in the carbonizing operations of a gas-works, purification, distribution, or the appliances through which consumption takes place, this is so. In the total of our abstracts last year, this country boasted only 26 more patents than came to us from abroad. In the carbonizing department however, we cannot take credit for any great superiority, excepting in certain directions; and in the course of this article, an endeavour will be made to show in what particulars thought, experiment, and invention have been at work. It is remarked, however, that in the inventions which come to us from the Continent, the sources from which they emerge are very restricted, which is no doubt a result of the retention in comparatively few hands of Continental retort-house structural work. But the balance in numbers with this country in new inventions in connection with gas manufacturing systems is only obtained by the greater enthusiasm shown abroad for gas producers of various types. In the purification department—in plant and processes—this country shows a slight advantage; and the same may be said in residual products work. Beyond the gas-works, and in appliances for the utilization of gas in various ways, there is a continued augmentation of attention by inventors at home; and this is especially the case in the production of incandescent light fittings and even of mantles. As to whether the "improvements" have generally any real value, we will not pronounce an opinion on the insecure basis (for judgment) of patent specifications; but the fact remains that, since the incandescent mantle market of this country has been thrown open, sterility has been displaced by fecundity through the constantly broadening interest of those of inventive propensity in all that appertains to the incandescent gas system.

Commencing our rather more minute survey of the inventions of which knowledge was obtained through the publication of the specifications during the year, it is interesting to observe that, getting right back to the root of gas manufacturing work, the furnaces of retort-settings and the construction of the beds generally still have an attractive influence; and it is of importance that, while methods and processes having for their object the cheapening of retort-house labour now appear to be receiving the unremitting thought of many men, the economics of the process of

carbonization itself should not be ignored. We cannot have attained finality within the settings themselves. Therefore it is noted with pleasure that to proposals associated with the construction of retort furnaces and beds, at least nine contributions were made during the year, five of which came from abroad. Three of the specifications referred particularly to the inclined-retort system, which is evidence that the view of many men is not shared by all, that the new types of stoking machinery for horizontal retorts have settled once and for all the prospects of the inclined system becoming universally regarded as the most economical system of carbonization. The step from the inclined to the vertical retort is a great one, but not so great as from the horizontal to the vertical; and there is no doubt that to the inclined system of working is largely due the revival of interest that has been evinced in the vertical setting of retorts both in this country and on the Continent. We had expected that, long before this, America would have done something towards elucidating the question whether or not the system possesses any merits superior to those possessed by other carbonizing systems; but nothing has, so far as our knowledge goes, been done there in this direction. Our specifications for last year, show that three new proposals connected with this form of retort were made by engineers in this country; and an equal number came from abroad. But it is singular, and savours somewhat of scepticism, that so few men should be working on these lines, seeing that the results so far are promising of success being eventually achieved. If the promise is not fulfilled, there will be great disappointment. Further than saying this, no one can at present go. It is also worthy of remark that, while inclined retorts have an arch-antagonist in London, the same gentleman is responsible for a vertical retort with a horizontal clearing chamber below, making the arrangement look something like an inverted T. But because he has patented this retort and system of discharge, it cannot be assumed that it betokens any partiality for the system. While on vertical retorts, it may also be noted that some of the new ideas for gas producers which have come before us during the year include examples containing a central vertical retort; the intention being to utilize the heat of the producer in carbonizing charges in the central retort, for the making of two kinds of gas—for instance, gas for heating in the producer and lighting gas in the vertical retort. Another patent to be noted here is one from abroad which has for its object the strengthening of vertical or horizontal retorts. This little digression has taken us from the continuity of line which we had struck for dealing with the specifications; and for the moment return must be made to the horizontal and inclined retort-settings, in order to show that their fittings have not escaped further consideration. There were six suggestions placed to the credit of this country in this respect during the year; but not one was imported. There is a new proposal for feeding the water on to the furnace bars of retort furnaces, one connected with retort-lids, and a third is designed to prevent the choking of ascension-pipes; while the feeding of inclined retorts has attracted one inventor, and two others have been devoting themselves to making improvements in the stops and mouthpieces of the same form of retorts. The hydraulic main, too, has received the further notice of one English inventor and of one abroad. Even the repairing of retorts has not been lost sight of, with the result that we have a new retort cement and a form of pulverulent material for coating and joining retorts.

In regard to other gas manufacturing systems, we must revert to the exploration and exploitation of gas generators and producers, which go merrily on. But it would appear to be indicative of a greater belief in them abroad than in this country when it is observed that, against thirteen specifications for them of foreign origin, we can only oppose five. Some of these are particularly devised for gas-engine use, the suction type is represented, the dual system of producing gas already referred to finds place among them, while others contemplate the production of poor gas free from tarry matters. Not far removed from these systems, we have an invention of certain fuel compounds for use in generating gas; and there is another form of the hoary fancy for making gas from wood. In this particular group, we have a couple of specially novel features. The mind is carried back to what is recorded of the early days of gas manufacture, when gas was distributed in cylindrical vessels from door to door. Here we have a suggestion for the reduction of gas by compressors to a liquid state, and, after being cooled, drawn off into suitably-formed bottles for distribution. The second novelty is Pearson's system of what has, for simplicity, been described as the chalk-gas process, about which no new development is heard, though it is long since notice was first taken of it in the Press. Mr. Pearson would be quite a benefactor to mankind if he could satisfactorily prove that our vast chalk deposits could be economically utilized to assist in conserving the wealth of coal upon which our country mainly depends for its prosperity. It may be taken as illustrative of the trend of events in this country—the dropping to a lower standard of illuminating value for gas, in view of the incandescent mantle and the large heating uses of gas—to notice that there are only two oil-gas introductions from abroad, and none home produced; and only two native enriching processes, with two foreign air and gas carburetters.

While speaking of producers, water-gas apparatus should have been mentioned; but these are worth an independent note, even though there were no particularly striking innovations. It, however, but rather induces the feeling that there is little interest taken in this country in the development of improvements in this system of manufacture to find that there were only two proposals in this line for which patents were taken out by British inventors, as compared with half-a-dozen sent from abroad. Two of the arrangements propose the combined production of water and coal gas; while a third contemplates the use of small and dust coal.

This exhausts the plant and processes which have special reference to the production of gas; but we must again return to the retort-house in order to note with satisfaction that the improvement of the methods of charging and discharging horizontal retorts still have a superior fascination for those of a mechanical bent of mind. This is only natural, following upon the surprising success that attended the advent of the coal-projector in the old-world city of Bruges; and thus we have registered among our specifications abstracts of no less than six inventions from British sources connected with the operation of charging (not counting a new form of machine scoop), and half that number hailed from abroad. The discharging of gas-retorts has also claimed a fair amount of study, with the result that we have had five fresh conceptions to put under notice, three of which have crossed the water. Conveying hot coke still brings forward the specialists in this line of plant; but it does not pass observation that along this path of improvement inventors abroad do not appear to be able to raise much enthusiasm—for of five specifications, only one found birth outside this country. In America, as well as in this country, the utilization of the bucket form of conveyor for gas-works purposes is courting more attention; and we should not be astonished to find it receiving a greater amount of adoption than heretofore. Among the systems of conveying, perhaps the most unique was that which emanated from Ilford, and proposes the transmission of coke by compressed air or jets of steam, so as to "dispense with mechanical conveying and its attendant disadvantages."

It has been before remarked in these annual surveys of the patent specifications that other parts of the plant of a gas-works have not been honoured with much attention; and if it were not for the spurt in interest that curiously has been made just at the present time in purification plant, the field of invention within gas-works walls, but outside the retort-house, would have been barren indeed. Sufficient interest was found in it for notice to be made of a newly patented form of rotary blower or pump, which, however, was an exotic; and only one addition was made from London to the methods of condensing and cooling gases. This brings us to the new proposals connected with purification; and here we have an assortment of ideas for the betterment of plant, processes, and product, to the aggregate of fifteen, nine of which are of British origin. There is no necessity to specify all the subjects; but among the more notable appear the specifications of the grids known as the "Jager," and those with which the name of Mr. Marshall is identified. Then we have a British proposal for economizing the space and weight of the connecting-pipes of purifiers; a couple of descriptions of purifier-valves; and a fresh idea for travelling-cranes for removing the lids of purifiers. A little out of operating sequence, it may be mentioned that tower scrubbers have one British representative; and washers two from abroad, and one of home production. Other specifications deal variously with means for the extraction of suspended and tarry matters, sulphuretted hydrogen, carbon disulphide, and naphthalene. The record in this department is not by any means an unsatisfactory one. Then we have an extremist—not of this country—who has a little thing for arresting any impurity which may escape past the consumers' meters.

Before leaving the gas-works, as the remaining gas plant is not represented (excepting perhaps one station meter by a foreign inventor) by improving notions, we may break off to remark that the plant and methods involved in the treatment of residuals appear to be receiving increased consideration on this side; in one or two years, it may be remembered, we did not take a very prominent place in this line of invention. Last year, however—it may be purely accidental—the British specifications in this regard outnumbered those from abroad; this country showing seven against five. Among the home productions, there is a proposal for treating gas liquor; and there is also a new ammonia still. Tar has claimed additional notice, having on its own account no less than four specifications, three of which are natives. There is one for the elimination of water from tar; another for separating the phenols of coal tar from the neutral constituents; while a third describes how to solidify tar for transport. The distillation of tar is dealt with in a patent from abroad. In other processes referring to residuals, including cyanide recovery, there are three foreign specifications and one British. Interest in the question of cyanide recovery does not appear to spread very extensively in this country; no doubt principally for the reason that too great an interest would make the process profitless. Sulphate of ammonia has received attention in a couple of specifications—one British and one foreign. Still on residuals, we find a proposal for treating coke, in order to fix any arsenic there may be in the ash of the fuel when it is burnt. Then there is the idea for constituting the spent lime and clinker of gas-works a profitable "residual," by making from these waste materials bricks and other moulded articles. The success of the trial work in this direction is well known.

In the gas distribution department, there is not much to notice. In governors there is only one British specification, which is not exactly counterbalanced by a gas-pressure regulator. Connected with canalization, there are new, or supposed to be new, ideas

to the number of six English and five foreign. There is a variety of expedients for facilitating the work of making connections, which cannot all be individually mentioned—notably, apparatus for tapping and drilling mains under pressure, new unions, joints, and so forth. A method of strengthening pipes, one referring to pipes and conduits specially constructed for positions where electrical or corrosive action is likely to occur, and another for localizing leakages in underground pipes, are among the things that the inventors are hoping will benefit mankind in general and gas suppliers in particular. Passing from the distribution system, we come to a few new suggestions in meters; but except in the prepayment class, the showing is not imposing. This country and one other only save themselves by one representative each in wet meters. There is nothing in ordinary drys of which to take note. There is one proportional meter from America. In the prepayment line, there are seven new arrangements, all of home growth. It is rather singular that improvement in the construction of prepayment meters abroad does not seem to make any marked way, unless the absence of patents from abroad in this respect denotes that what improvements are made in other countries are not considered of sufficient importance to protect here. But that can hardly be. Attention is, the records of the year show, also being directed to counting and registering attachments for meters.

Only a few years ago, we remember that this country hung far behind the Continent in patentable ideas in connection with incandescent gas lighting. But times have changed; and now in every department—excepting in the means for automatically igniting and extinguishing gas or in self-igniting burners—this country is keeping neck to neck in the race. Altogether, in the lighting department 114 patents were noticed during the year, 56 of which stand to our own credit, while countries abroad can only show an excess upon this number of 2. Owing to the quantity, we must be excused from making any particular allusion to the inventions, save to point out the lines in which improvement was principally sought to be effected, or special novelty. Incandescent burners took the lead in point of number; and this country, strange to say, was well ahead with ideas aiming for improvement. Inverted burners made a good showing with fifteen specifications, seven of which originated at home. Great aspiration is disclosed in increasing the illuminating value of incandescent lights without having recourse to higher pressures; there being little short of a dozen proposals in this direction. The admission of oxygen to the lighting mixture at the point of combustion is a method that is the subject of two patents; but there is doubt on the point of whether the additional candles are quite worth the cost—in other words, whether the additional illuminating value cannot be obtained by cheaper methods. Another idea, which is not new, is the use of a small mantle inside a larger one, so as to form an annular space for the flame, and thus obtain light from two mantles with only one flame. The value of this is also questionable; and there must be a difficulty in maintaining mantles in a perfectly cylindrical and parallel state. Special precautions, too, we can imagine, would be necessitated in the manufacture of mantles destined for this purpose; so that, at present, we are not favourably impressed with this particular idea. Methods for mixing gas and air were covered by eight patents, seven of which were imported, and five of them bore the name of "Selas." Mantle making invited the attention of several inventors; but there is not the excitement in this branch that was seen but a few years since. There were five proposals in this country and three from abroad, one of the latter being the D'Heureuse method of fabric weaving which has been acquired by the Welsbach Company. One patentee has proposed a new material for the manufacture of incandescing bodies; and Baron Auer von Welsbach is seen to have been further investigating the subject of the manufacture of metallic alloys having pyrophoric action and their application to the purposes of ignition and illumination. Means for regulating the gas and air supply to burners are shadowed out in four specifications—two British and two foreign. But anti-vibrators and bye-pass taps only boast two new comers. There are several little ideas, one or two showing novelty, for supporting and protecting mantles; and incandescent light fittings have also had additions made to their already large range. High candle power lamps and street lamps have not been very productive classes; but they have not been altogether neglected. We must, as already indicated, take a back-seat in the matter of lighting and extinguishing burners from a distance or at stated times; as also in self-igniters. Our friends abroad seem to have a particular liking for devices of this kind, having in the year placed to their account eleven new proposals against our own modest three. Without doubt, the greatest novelty of the year connected with burners is the one which is capable of burning under water and other liquids, and which was the centre of much public attraction at the recent International Gas Exhibition.

The effort to improve gas stoves and fires has been going on apace in this country; and during the year we have recorded no less than eighteen inventions of British birth—it is true, of the extremes of merit—as against only one (referring to a burner) from abroad. Burners of various descriptions bulk largely; and there is one convenient arrangement which counteracts the propensity of the domestic servant for wasting gas by leaving boiling-rings alight when not in use. In this case, there is a bye-pass jet; and the placing of the vessel over the boiling-ring opens the gas-way and the gas is ignited. The removal of the vessel shuts off the gas, and causes it to be extinguished, leaving only the bye-pass jet alight. The greatest convenience that has been introduced in recent times has been the conjunction of a circulating system of hot-water supply, or water-heaters, with gas-cooking ranges; and examples were described during the year. A small arrangement proposes the regulation of the supply of gas to water-boilers; and there is described a convertible gas cooker and heater. Boiling and grilling arrangements have a place in the list; and gas-fires—one being of the condensing type—have had fresh contributions.

An excellent sign is the activity in gas-engine invention. We have taken credit in the past year for no less than eleven (including one from New Zealand) improvements in this direction, as compared with eight from the Continent. But there is no doubt about the increasing tendency of gas-engine makers to make provision for the attachment of gas-producing plant to their engines.

Only one point more; and this has reference to the testing of gas. Testing has not been a prolific field. But one proposal of special interest is Mr. Sugg's revolving arrangement bearing burners for varying qualities of gas; so that testing can proceed, no matter what quality of gas is for the time being supplied, without changing burners. Another home proposal is an apparatus for testing the value and quality of gas; while one is an introduction from abroad for determining the heating value of gaseous and liquid fuels.

This general view of last year's gas patent specifications (which through the force of circumstances have to be served up to our readers, as it were, piecemeal and indiscriminately week by week) will assist readers to fairly judge the course of recent thought and endeavour at improvement in gas manufacture and utilization. It is clear that the most pronounced attention is being devoted to the retort-house operations, together with constant but restricted prosecution of work with the object of perfecting vertical retorts. Producers are also having a noteworthy innings. Purification is not by any means a neglected branch; and, notwithstanding the widespread adoption of prepayment gas-meters, workers apparently still find plenty of room for improvement. Flat-flame burners have entirely fallen before incandescent burners, which, with the mantles and accessories, afford a remarkable field for the exercise of inventive genius. Gas-engines are a good subject; and, as just seen, the details of gas fires and cookers have not escaped notice.

THE LAW AS TO WORKMEN'S COMPENSATION.

Some Points from the Committee's Proceedings.

Among the data brought to the attention of the Departmental Committee on the Law Relating to Compensation for Injuries to Workmen (whose proceedings have been noticed in the last two numbers of the "Journal") was an informative table prepared for the St. Louis Exhibition by the Labour Department of the Board of Trade. This gives the mean annual death rate from industrial accidents per 10,000 employed in the principal trades from 1898 to 1902; the average for all the occupations named being 7 per 10,000. Seamen come first with the enormous figure of 64·5, coal miners next with 12·9, then quarrymen with 12, metal miners with 11, and railway servants with 9·6. The average for all factory operatives is 1·9 per 10,000; and in the analysis, gas workers (owing, of course, to their being combined with the chemical and explosive industries) head the list with 3·9. We should like to have seen this item still further split up. The remaining figures are as follows: Metal workers, shipbuilders, machine makers, &c., 3·2 per 10,000; saw mill workers and carpenters, 2·7; glass, clay, stone, &c., workers, 2·4; food, drink, &c., factory operatives, 2·1; textile workers, 0·6; and other factory operatives, 1.

The precise position of gas-works service with regard to the relative danger of different trades is better indicated by a statement prepared for the Committee by Mr. C. E. Troup, Assistant Under-Secretary of State for the Home Department. The statistics of the Registrar-General show that there are 1000 deaths per annum among 61,000 men between the ages of 25 and 65; and of these 56 are due to accident. Reckoned on this basis, bargemen, lightermen, and watermen have the most dangerous work; for the number of deaths per annum by accident out of 61,000 persons so employed would be 223. The figure for coal heavers would be 144, for coal miners 141, for manufacturing chemists 98, for factory labourers (undefined) 80, for bricklayers, masons, and builders 54, and for gas-works service 48. The last-named come thirty-fifth on the list; and, as will be seen, they have a very much lower comparative number of deaths by accident (just under one-half) than those employed in the works of manufacturing chemists.

Several of the witnesses who appeared before the Committee expressed themselves in favour of a scheme of national insurance against accidents; the idea being that by this means workmen would be treated better than they can possibly be by private insurance companies, and that the difficulty of insolvent employers would thus be obviated. Mr. D. C. Cummings, of the Boiler Makers' and Iron and Steel Shipbuilders' Society, suggested

that a public fund should be provided by the employers; the premiums probably being fixed at different rates, so as to meet the fact that some industries are more liable to accident than others. Another witness—Mr. J. N. Bell, of the National Amalgamated Union of Labour—thought there should be a national fund, towards which all employers should contribute in proportion to the amount of their wages bills; this fund being supplemented by a grant from the State, so as to relieve the employers to some extent. There appears to be a very prevalent feeling that the Compensation Acts have had a prejudicial effect on the employment of old men and those suffering from physical defects; and it is hoped that some such scheme as the one suggested would remove that tendency. Be this as it may, there is certainly something in Mr. Bell's argument, that as not only the employers and workmen, but the nation generally, benefits from the industries of the country, it cannot be considered unfair that the nation should bear part at least of the cost of compensation for accidents. While, however, there are employers who are willing to grant, on their own initiative, even larger benefits to the men than the Acts provide, it would be a great pity to deprive them of the opportunity of doing so by the introduction of a compulsory national insurance system. The case of small employers, to whom a serious accident to their men might mean financial ruin, is, of course, different; but they are already able to insure themselves, and they might be compelled to do so without the provision of a national scheme. The question of the solvency of the insurance companies themselves might possibly create some difficulty; but this could be overcome.

In France, there is an Act which makes it almost compulsory to insure; and they offer State insurance, at an average rate of something like £4 per cent. on the wages, including all trades. An insurance company doing business there have to pay a deposit which begins with £16,000; and a reserve has to be kept up (including this amount) of 2 per cent. of the wages, or, roughly speaking, 50 per cent. of the premium income. This high rate is partly accounted for by the fact that settlement of claims is by way of annuity; and there is no limit. Here the charges vary; but one or two of the companies placed before the Committee tables giving the premiums for different trades. For gas workers, one Company's rate is 9s. per cent. of wages to cover the legal liability of the Act, and 11s. to provide in addition for the payment of half wages during the first fortnight; while another Company state their approximate rates as 7s. 6d. and 10s. respectively. In France, however, there is also a schedule of charges—the £4 per cent. of wages being an average for both dangerous and non-dangerous occupations. The figure named would thus, presumably, not apply to gas workers.

A PECULIAR FEATURE OF THE RECENT FOG.

The "Lancet" (Jan. 7) says: During the time the recent fog was densest on the ground, a curious phenomenon was witnessed in the "Lancet" offices and laboratory. The flames of the bunsen burners attached to the gas-stoves, as well as of those used for laboratory purposes, which are normally of a bluish tinge, became a bright yellow colour, which on examination with a spectroscope proved to be due to sodium. The characteristic bright yellow colour of the flame was well marked, and the usual soda line in the spectroscope was very brilliant. On examining the air, no definite evidence either of sulphates or of chlorides could be obtained. The interesting questions are, What was the origin of the sodium, and in what form did it exist? It is easy to imagine sea air showing the presence of sodium chloride; but it is difficult to understand how, under the conditions prevailing during the fog, the air could contain particles of sea-water. It is true the fog was very general, and possibly some of it had its origin in the sea; but then no chlorides could be found in the air. Again, it may be conjectured that smoke might contain sodium salts derived from the combustion of coal; but we find that sodium salts are seldom found in coal. We do not know, and have had no means of ascertaining, whether there was a local disturbance at any chemical works or other places where sodium salts are likely to predominate; those salts for some reason or other becoming scattered, and thus giving rise to the curious flame phenomenon recorded. It was not due to our own laboratory operations; for the intense yellow coloration of the flame was evident in all parts of the offices, and the coloration was just as intense on the lower floors as on the top floor, where the laboratory is situated.

Referring to the statistics which we recently gathered as to the consumption of gas during the fog, Mr. Alex. A. Johnston, the Engineer and Manager of the Ilford Gas Company, writes: "Your articles giving the particulars of the abnormal demand for gas during the fog shows that the gas companies at least reaped a benefit from the four days' enforced darkness; and, among others, our consumption was correspondingly high. The increase in consumption for the four days—Dec. 21 to 24 inclusive—shows the high figure of 23·3 per cent., and for the total week an increase of 24·6 per cent. over the corresponding periods of the previous year."

COAL GAS AND RESIDUALS PRODUCTION IN THE UNITED STATES.

In making its annual canvass of the coal-mining and coke-making industries for the last two years, the United States Geological Survey has (says the "Iron Age" in a summary of the report of that body) extended its inquiries to cover all plants producing gas and coke from coal with the recovery of tar and ammonia. Reports were received in 1903 from 528 companies.

The total quantity of coal carbonized in 1903 was 5,843,538 "short" tons (of 2000 lbs.). The 528 companies produced 33,483,430,989 cubic feet of gas, of which 2,433,969,478 cubic feet were unaccounted for, and 31,049,461,511 cubic feet were sold. Of this total, 73·9 per cent. was sold for illuminating purposes, and 26·1 per cent. for fuel. The average price per 1000 cubic feet for all gas sold in 1903 was 97 cents. Prices for artificial gas are low in those States which have coal and natural gas among their resources. Such States are Illinois, Indiana, Kentucky, Ohio, Pennsylvania, West Virginia, and also Massachusetts, where a large portion of the coal gas made is a bye-product from coke making in retort-ovens.

The total production of coke amounted to 3,941,282 "short" tons, of which 1,882,394 "short" tons were obtained from bye-product coke-ovens, and 2,058,888 "short" tons were the product of gas-works. Since 1893, when the first plant of bye-product coke-ovens in the United States was completed at Syracuse, New York, the quantity of coke produced in such ovens has increased so rapidly that in 1903 7·4 per cent. of the total coke product of the United States was thus manufactured. The successful development of this industry has been largely due to the profitable disposition made of the bye-products obtained in the manufacturing process.

The total quantity of coal tar produced in 1903 was 62,964,393 gallons, valued at $2,199,969, or 3·49 cents a gallon. The largest production of tar in both 1902 and 1903 was in Massachusetts, with New York second, Ohio third, Pennsylvania fourth, and Alabama fifth. [The United States gallon equals 0·833 Imperial gallon.]

Only about 20 per cent. of the companies that manufacture coke and gas reported the recovery of ammonia, either in the form of ammoniacal liquor or sulphate. The total quantity of ammonia liquor produced and sold was 64,396,662 gallons, which would be equivalent to 17,479,759 lbs. of anhydrous ammonia, or 67,821,465 lbs. of sulphate. The total quantity of sulphate of ammonia produced and sold in 1903 was 11,925,752 lbs. The total production in 1903, reduced to its equivalent in sulphate, was 79,747,217 lbs.

Comparatively little progress has been made in the United States in the manufacture of chemical products from coal tar. Although over 50,000,000 gallons of coal tar are produced annually, millions of dollars' worth of chemicals obtained from coal tar are imported every year. A conservative estimate would place the total value of these products in the wholesale markets of the United States of America at $12,000,000.

WATER BILLS FOR 1905.

In the two preceding issues of the "Journal," the chief features of the Gas Bills for the ensuing session have been noticed. We now deal with the Bills which contain provisions relating to the supply of water.

The Bill of the Abertillery Urban District Council is to amend the Gas and Water Act obtained by the Local Board in 1894, so as to enable the Council to procure more water for the supply of their district from the Tillery Brook. It is proposed to abandon the construction of the reservoir and works authorized by section 4 of the Council's Act of 1902. Power is sought to make bye-laws to prevent the fouling of the water, and also to raise such sums of money as, with the consent of the Local Government Board, may be necessary for the works contemplated and for the general purposes of the undertaking.

The Accrington District Gas and Water Board desire to construct new works and extend their limits of supply. The former object comprises an enlargement of the Dean Clough reservoir, together with subsidiary works, all of which are to be completed within five years from the passing of the Bill; while the proposed extension will bring within the area of the Board the whole of the township and parish of Altham, in the county of Lancaster. When the reservoir has been enlarged, the Board will divert and impound the waters of the Dean Brook, which their predecessors, the Accrington Gas and Water Company, were authorized to appropriate under the powers conferred by their Act of 1869. The Bill includes provisions enabling the Board to increase their rates up to the amounts specified in the Bill, and to purchase from the Burnley Rural District Council the mains, pipes, and other plant used by them for the supply of part of the parish of Huncoat. Additional borrowing powers to the extent of £4000, and any further sum sanctioned by the Local Government Board, are required; and permission is sought to use the sinking

fund instead of raising money on loan. Other points in the Bill have been noticed in connection with the clauses relating to the supply of gas.

In a General Bill promoted by the Bangor (County Down) Urban District Council, power is sought to construct new water-works, consisting of a storage reservoir in the rural district of Newtownards, three filter-beds, a clear-water tank, a conduit or pipe-line, an approach road, and subsidiary works, and to appropriate all such streams, springs, &c., as can be taken or collected. The Council wish to be empowered to erect plant for furnishing a supply of sea water, and to open the streets for the purpose. Permission is sought to borrow £20,000 for the construction of the reservoir, aqueducts, mains, and other works; £2000 for laying subsidiary water-mains; and for the supply of sea water, such sum as the Local Government Board may sanction—all to be repaid within fifty years from the date of borrowing.

A Bill promoted by the Corporation of Birmingham mainly for the purpose of obtaining power to construct additional tramways and carry out certain street improvements contains a few provisions in regard to their Welsh water scheme. The first relates to the quantity of compensation water to be discharged from the Caban Coch reservoir. Under the Act of 1892 authorizing the scheme, the Corporation were empowered to take all the waters of the Elan and Claerwen at and above the dam of the reservoir, and of the tributary streams and springs, subject to the discharge of not less than 27 million gallons of water per day in a regular and continuous flow. It is proposed to reduce this to 20 million gallons, and certain other quantities of 22 millions and 5 millions stipulated in the Act to 17 and 3 million gallons respectively. The Corporation wish to be authorized to use any compensation water for the purpose of generating power or light, on condition that it is eventually discharged uncontaminated through the measuring apparatus in use. The above-named Act likewise contains certain provisions for the protection of the Board of Conservators of the Wye Fishery District; and an agreement has been come to between them and the Corporation for the modification thereof, in consideration of the payment to them of £8000, to be expended on improvements needed for the benefit of the fishery district. To this agreement, parliamentary sanction is sought.

A general Bill promoted by the Blackpool Corporation contains provisions for the extension to the whole of the borough of the limits within which, under their Act of 1873, they are authorized to supply sea water. The terms and conditions are to be such as may be prescribed. The charges determined upon are to be deemed water-rates, and the provisions of the Water-Works Clauses Act, 1847, in regard to their payment and recovery are to apply. The accounts relating to this part of the water undertaking are to be kept separate; and any surplus revenue is to be used, after meeting all claims, in extending and improving the works and forming a reserve fund. Should there be a deficiency, it is to be made good out of the district fund and the general district rate. Permission is asked to raise for the above-named purpose such sums as the Local Government Board may authorize. Another matter for which legislative sanction is sought is an extension, to sixty years from the date of borrowing, of the time for the repayment of the loan of £137,727, with interest, granted to the Fylde Water Board, with the consent of the Local Government Board, on Oct. 29, 1904, for the construction of a reservoir and subsidiary works.

The Bolton Corporation are applying, among other things, for authority to construct additional water-works of a rather extensive nature. They consist of five reservoirs, and various aqueducts, conduits, catchwaters, and pipe-lines connecting them. Compensation water is to be provided at rates and under conditions which are fully set out; and the Corporation are to be liable to penalties for failure to furnish it. On the completion of any of the works included in the Bill, a certificate in writing, under the hand of an engineer appointed for the purpose by the Board of Trade, on the request of the Corporation, is to be conclusive evidence. Permission will be asked to raise the sum of £752,000 for carrying out the scheme and the general purposes of the water undertaking; the money to be repaid within a period of sixty years from the date of borrowing.

A Bill promoted by the Corporation of Bootle to obtain authority for the extension of the borough limits so as to include the detached portion of the township of Orrell and Ford known as Orrell, contains a clause to the effect that, notwithstanding anything contained in section 5 of the Liverpool Corporation Act, 1890, dealing with the supply of water to the borough of Bootle, the existing charges within the added area are to continue.

Further powers are sought by the Brompton, Chatham, Gillingham, and Rochester Water Company. They wish to construct two pumping-stations, a covered service reservoir, and an aqueduct or pipe-line connecting one of the stations with it; also to carry out subsidiary works. Additional capital is required to the amount, inclusive of premiums, of £108,000, to be limited to 7 per cent. if issued as ordinary, and 6 per cent. if as preference. It is to be put up to auction or tender, and the shares or stock not sold are to be offered to the shareholders, employees, or consumers. Borrowing powers to the amount of one-third of the additional capital are asked for.

The Bill of the Budleigh Salterton Urban District Council is to obtain sanction for the construction of additional works, consisting of a storage reservoir in the parishes of Colaton Raleigh and Bicton, a pipe-line connecting it with a service reservoir and filter-beds in the first-named parish, a compensation reservoir, and a second pipe-line. It is proposed to ask for a period of seven years for the completion of the works. The charges for water are to be 2d. per week for houses of less than £5 rateable value, 3d. per week up to £10, 7 per cent. up to £30, and 6½ per cent. beyond this amount. Water supplied by meter is to be charged for at a rate not exceeding 2s. per 1000 gallons. Permission will be sought to borrow £12,100 for carrying out the works specified in the Bill, and, with the approval of the Local Government Board, such further moneys as the Council may require for their water undertaking; the former to be paid within sixty years from the date of borrowing, and the latter in such time, not exceeding this period, as the Board may sanction.

An Improvement Bill promoted by the Colne Corporation contains some provisions in regard to their water undertaking. They ask for authority to maintain, extend, and enlarge the well, pumping-station, and other works constructed by them at Wycollar; and so long as these suffice for the needs of the borough, they wish to be relieved of the obligation to construct the Wycollar reservoir and the works specified in section 14 of their Act of 1897. Among the other provisions of the Bill is one sanctioning the allowance of discount not exceeding 5 per cent. for prompt payment of water-rates, and notice is to be given thereof on every demand note. The Corporation will ask permission to borrow £10,000 for water-works purposes, to be repaid within sixty years, or to use the sinking fund instead of borrowing.

In conjunction with powers which are being sought by the Corporation of Croydon for improving the condition and government of the borough, application will be made for authority to frame bye-laws to prevent the pollution and waste of water. They are to be in force in the area from or through which the waters flow, or so much of it as may be defined; and they are to be subject to the approval of the Council of every district comprising part of the area within which they will be operative. The Corporation undertake to compensate parties interested as owners or occupiers of lands who may be injuriously affected by the restrictions imposed by the bye-laws; the amount to be determined, in default of agreement, under the Arbitration Act, 1889.

An Improvement Bill promoted by the Heckmondwike Corporation contains a few clauses relating to water supply. The Corporation wish to have power to recover certain expenses payable under section 103 of their Act of 1876 from the owner of the premises concerned as well as from the person on whose credit the water has been supplied. It is proposed to enact that communications with the water-mains are to be made only by the Council, at the request of the owner or occupier of premises; and they will ask that the powers granted in respect of premises within their area shall be applicable to those which are partly outside the limits of supply. Permission will be sought to put up and continue drinking-fountains and cattle-troughs.

The Bill of the Higham and Hundred of Hoo Water Company is to empower them to raise further share or stock capital to the amount, including premiums, of £24,000, to bear interest at the maximum rate of 6 per cent. per annum, and to be offered by auction or tender. In respect of the new capital, borrowing powers to the extent of one-third will be applied for. The Company will seek authority to make provision for detecting and preventing waste, and for laying pipes in streets not dedicated to the public.

The Bill promoted by the Hythe Corporation is, among other things, to empower them to construct new water-works, consisting of a well, pumping-station, and service-tank, at Saltwood, and four conduits or pipe-lines, which are to be completed within five years from the passing of the Bill. Authority will be sought to make bye-laws for securing the purity and preventing the waste of the water; to lay mains beyond as well as within the borough, and also in streets not dedicated to the public use; and to supply water by measure, and sell or let meters. The rates for domestic supplies are to be 13s. per annum for houses of less than £10 gross estimated rental, and up to 7½ per cent. above this figure. Where premises are supplied by meter, the Corporation will provide water for domestic purposes at a rate not exceeding 1s. 6d. per 1000 gallons. Application will be made for power to borrow £11,000 in respect of the works specified, to be repaid within sixty years.

(*To be continued.*)

An experimental apparatus for sterilizing water, designed by Mr. P. G. Griffith, which is now on view in London, is based on the fact, which he claims to have proved by experiments, that in order to kill the organisms of water-borne diseases, such as enteric fever, cholera, and dysentery, it is unnecessary to have recourse to a temperature so high as boiling-point, but that they are immediately destroyed by heating the water to any temperature above 73° C. He takes advantage of this circumstance to economize heat by not using temperatures above 80° C. for the operation of sterilizing; and he effects a further economy by employing an interchange cooling arrangement by which the heat of the water which has passed through the boiler is transferred to that which is on its way to be sterilized. In this way the ingoing water is made to enter the boiler at a considerable temperature, the consumption of fuel being thus reduced; while a corresponding cooling is effected in the sterilized water, which therefore becomes available for drinking purposes much sooner than would be the case if it issued almost at boiling-point.

PHOTOGRAPHY BY GASLIGHT.

PHOTOGRAPHY by gaslight has been a matter of interest now for some years—indeed it must be at least fifteen years since our attention was first drawn to the subject, and interest claimed for it. As illustrations in our columns and unpublished personal photographs have proved, the highest pitch of perfection can now be obtained, and the work of the photographer be prolonged as long as his subjects wish in the dark hours of the night, cheaply by the aid of incandescent gas-lights. But, notwithstanding this, photographers do not generally appear to take kindly to this system of illuminating their studios for carrying on their work. An occasional reference to the matter, however, may assist in forwarding interest in it.

Here we have three photographs of the show-room of the Stafford Corporation Gas Department taken during its ordinary lighting by incandescent gas-lamps. Forwarding them, Mr. Hubert Pooley, the Gas Engineer and Manager, informs us that (bear in mind this is a dark interior) when the exposure for one of the photographs was commenced, there may have been a little daylight—it being then about 3.30 p.m., but the weather was very foggy and dull at the commencement. The exposure lasted till 5.30. We are inclined to think this was unnecessarily protracted if the room is well and equally lighted by ordinary incandescent lamps; and, of course, this is not the character of lighting required by photographers, besides which they need a special arrangement of fittings. The show-room illustrated measures some 25 ft. by 16 ft.; and the trade done through it is quite an important item in the business of the undertaking. It may be of interest to mention that last year a profit of £600 was made from this department alone. During last quarter, between £400 and £500 worth of inverted incandescent burners and suitable fittings were sold; and a special feature is being made just now of gas-fires—these being fixed free (up to £3 in value) for consumers at hires of from 3d. to 1s. 6d. per quarter. If a gas consumer chooses to pay for the cost of fixing and the necessary piping to a separate meter, gas is sold to him for heating and cooking purposes at a rebate of 4d. per 1000 cubic feet off lighting charges.

WATER SUPPLY OF LAUSANNE.

IN a previous issue of the "JOURNAL" (*ante*, p. 88), we gave some particulars in regard to the gas supply of Lausanne, as presented to the members of the Swiss Association of Gas and Water Engineers, on the occasion of their annual meeting in that city in September last, in a paper read by M. Chavannes. We now supplement them by others in respect of the water supply, which was the subject of a paper by M. Chastellain, the Director of this branch of the municipal services.

At the present time Lausanne is supplied with potable water chiefly from the communal works and from those of two private Companies formed by landowners, entitled respectively the Pierre-Ozaire Company and the Moilles Donnes Company. For industrial purposes, water is furnished by the Bret Company. M. Chastellain confined his observations to the supply obtained from the communal works. These are fed by three groups of springs—the Jorat, yielding about 330 gallons per minute; the Pont de Pierre, yielding 770 gallons; and the Pays d'Enhaut, furnishing about 1550 gallons per minute in winter and 2860 gallons in summer. The water coming from the first-named source is reserved for the higher portions of the city—say, 2000 to 2250 feet above the sea—Lausanne being, as explained in the previous article, a place where the levels vary considerably. The water from the other springs is conveyed into one reservoir at Calvaire, whence it is distributed, by gravitation, to the portion of the city lying between the 2000-feet level and the Lake of Geneva. The average total supply from all the springs is, in round figures, 3300 gallons per minute. It is not a little surprising that no advantage has been taken of the proximity of the lake, which is only a mile from, and about 400 feet below, the centre of the city, to utilize its "clear, placid" waters, which have been admired by thousands of people since Byron applied these words to them, and which are so pure as to need no treatment before they are supplied to the inhabitants of Geneva. The cost of raising the water to the level of the city may, however, have been an obstacle.

The Jorat springs are small and shallow, and do not possess any feature of special interest. They are situated about $3\frac{3}{4}$ miles from the centre of the city, at an altitude of 2300 feet. The Pont de Pierre spring is farther off—being only about a mile from Montreux, which is some 18 miles from Lausanne; and it rises at a height of 2150 feet. The water is collected in a tunnel 33 feet long formed in a soil composed of gravel and sand alternating with beds of clay. Its yield fluctuates very little; being scarcely 25 per cent. of the maximum and 33 per cent. of the minimum. The Pays d'Enhaut springs are under the control of the Vevey-Montreux Electric Lighting Company, who supply the municipal authorities of Lausanne with water in bulk, at a storage tank at Sonzier. The mains in connection with the Jorat springs are of the ordinary kind. The Pont de Pierre conduit is composed partly of cement and partly of cast iron. The former portion is 19 inches, and the latter from 12 to 20 inches in diameter; the respective lengths being 17,700 and 15,150 yards. The pressure is equal to a head of 400 feet. There are flood-gates with overflow pipes at various points. The main starts practically at the level of the spring, and it falls about 200 feet. It will deliver 1100 gallons per minute. The Pays d'Enhaut main is of cast iron, about 20 inches diameter, with ordinary lead joints. It starts at Sonzier at an altitude of 2300 feet, and reaches Lausanne at the 1600-feet level. It has a delivering capacity of about 2500 gallons per minute. Owing to the irregular contour of the ground, and to the necessity for taking the shortest possible route, the mains follow an exceedingly difficult track. They descend and ascend steep ground, necessitating the use of a number of syphons. Between Sonzier and Lausanne there are six valve-chambers, all situated at high levels, and furnished with flood-gates and

over-flow pipes. By means of these the water is gauged in its course, and the volume accurately measured, so that leakages can be detected. There are also five sluice-gate chambers at the high points, with overflows. In addition, there are fourteen similar chambers without overflows; also automatic air-valves and other appliances. During its course, the water can be gauged six times, stopped at 25 points, and run off by 11 over-flow pipes and 34 waste weirs.

For the storage of the potable water, there are three reservoirs—viz., the Bellevaux, having a capacity of 88,000 gallons; the Calvaire, which will hold 880,000 gallons; and the Montalègre, of like capacity. It is intended to construct two others in the higher localities—one in the suburbs, for 220,000 gallons; and the other at Sauvabelin, for 110,000 gallons. The three high reservoirs will store the water from the Jorat springs, and serve three districts at altitudes between 2300 feet and the level of the lake. The highest reservoir (the Montblesson) has an overflow connected with two below it (the Bellevaux and the Calvaire), so that no water is lost. The Calvaire and Montalègre reservoirs (the lowest) are fed mainly by the Pont de Pierre and Pays d'Enhaut springs; and they serve districts lying between 1500 and 3000 feet above the level of the sea. The Pierre-Ozaire Company have a reservoir of 22,000 gallons capacity; and the Bret Company two reservoirs, with a combined capacity of 440,000 gallons. The volume of water passing into them per minute is about 2600 gallons. They are located at a height of 2000 feet above the sea. They supply, without change of pressure, the water required for power and industrial purposes in a district which lies at an altitude of 1230 feet.

The mains for the supply of potable water are 30 miles long, and they deliver at the rate 3300 gallons per minute. The supply per head of the population (50,000) is about 95 gallons. Reckoning it at 44 gallons, the supply would be adequate for double the present number of inhabitants.

COMPENSATION TO THE LONDON WATER COMPANIES' STAFFS.

Those of our readers who have read the reports of the proceedings at recent meetings of the London Water Companies will probably remember that various references have been made to the position of the officers and staffs in view of the acquisition of the undertakings by the Metropolitan Water Board, and of the extra work entailed upon them thereby. The Companies are authorized to retain, out of the compensation money awarded to them, a certain sum for distribution among the members of the respective staffs; and in some cases liberal amounts have already been allocated for the purpose. For example, the Grand Junction Company, besides giving £5000 to the Directors, have voted £12,000 for distribution among the "officers, clerks, and others, who have rendered special services to the Company." Their neighbours, the West Middlesex and Chelsea Companies, have either distributed a bonus or have promised one. The Kent Company are, we believe, following a similar course; while the Directors of the East London Company intend, at the general assembly of proprietors to be held on the 26th inst., to ask permission to have at their disposal, out of the sum of £26,778 retained out of the compensation-money for this and other purposes, "a sum not exceeding 7000 guineas for distribution as he Board think fit among the staff and others." Over the water, the shareholders of the Southwark and Vauxhall Company have already sanctioned the apportionment of £10,000 among the staff. It will thus be seen that this question of recognizing the services of the staffs has been dealt with by six out of the eight Water Companies; and doubtless it has not been overlooked in the Board-room at Clerkenwell, though, of course, the proceedings there have never been made public. There remains the Lambeth Company, the Directors of which have not yet, as we gather from a circular which has been issued by some of the shareholders, made any move in this direction. They have been authorized to retain £41,000 of the compensation money for certain specific purposes; and already £22,000 of it has been used. There is consequently a balance of £19,000. This sum is liable to a charge of £500 and the costs of the liquidation, which are not understood to be heavy. When these payments have been met, there will be a substantial sum at the disposal of the Directors; and the signatories to the circular are suggesting to their fellow-proprietors that it might be appropriately employed in making a grant to the staff, and even a possible addition to the allowance to the Board. The suggestion appears to be all the more justified from the fact that, though the prosperity which has attended the Company has enabled about £68,000 to be distributed in making up back-dividends, the staff have not participated therein. This has not been due to the excessive liberality of the salaries paid, which, according to the circular, have been less in relation to income than those of any other Company. The matter to which attention has been called deserves, as we have no doubt it will receive, the due consideration of the Directors. Meanwhile, an expression of the shareholders' views upon it will be of assistance; and it is to obtain this that they are being addressed.

THE THEORY OF THE INCANDESCENT MANTLE.

By Professor Vivian B. Lewes, of the Royal Naval College, Greenwich.

[A Lecture delivered on Jan. 13 before the Junior Institution of Engineers]

Ever since the epoch-making discoveries of Baron von Welsbach—which commenced in 1885 with the method of forming a mantle of refractory oxides that should fit the flame, which were continued by the discovery in 1886 of the transcendent virtues of thoria as a mantle basis, and which culminated in 1891-92 in the still more wonderful discovery of the power exercised by a trace of ceria in awakening the marvellous power of light emissivity which the mantles of to-day possess—speculation has been rife as to the causes which lead to the incandescent mantle giving us 20 candles of light per cubic foot of gas consumed, instead of the small fraction of that amount obtainable when we rely upon the incandescence of carbon particles in the flame for the production of light.

From the time when Murdoch first showed the wonders of his "flame without a wick" to the admiring rustics of Redruth, down to the present day, the source of the light emitted by an ordinary hydrocarbon flame has afforded a happy hunting ground, as well as a battlefield, for scientific observers; and though everyone now admits that it is the incandescence of minute carbon particles within the flame that emits the light, diversity of opinion still exists as to several minor points, while the incandescence of the mantle offers a still wider field for speculation and research.

It was the discovery of the lime-light in 1826 which first called attention to the great light-giving power of certain unburnable refractory substances when heated to a high temperature; and Goldsworthy Gurney having shown that a lime-cylinder could be raised to incandescence by the flame of the oxy-hydrogen blow-pipe, Drummond utilized the light shortly after in a survey of Ireland. From that day to this it has been a faithful servant to the lanternist, when the electric arc was unavailable. It is clear, however, that the heat required to raise such a mass of material as a lime-cylinder to incandescence is very considerable, as radiation and conduction both tend to dissipate the heat and prevent the necessary temperature being reached. That this is so, can at once be seen by holding a coil of thick platinum wire in a bunsen flame, when the metal is hardly heated to visible redness. A wire of medium thickness, however, is quickly raised to bright redness; while a thin wire is rapidly raised to incandescence, and in a few minutes melts in certain parts of the flame.

Realizing this, attempts were made to reduce the size of the mass to be heated; and buttons of zirconia and of magnesia were for a short time used for street lighting in Paris—an oxy-coal gas flame yielding the necessary temperature. The high cost and the constant renewals needed, however, soon led to the abandonment of this attempt at incandescent lighting; and the next step forward was the discovery by Talbot, in 1835, that even the feeble flame of the spirit lamp sufficed to heat lime to high incandescence, if only it could be sufficiently finely divided; and this he did by soaking blotting-paper in a salt of calcium and incinerating it. Up to this time, it was only the spirit lamp and oxy-hydrogen blowpipe which gave flames free from carbon particles; but in 1848 Gillard introduced the intermittent process of making water gas, and, desiring to use it for lighting as well as heating, made a mantle of fine platinum gauze to fit the flame. For a time he obtained excellent results; but the surface of the metal soon became eroded by the flame gases, and the light-giving power fell to a useless point. Although inventors have resuscitated the platinum mantle in various forms since Gillard's early attempts, the same trouble has in every case proved fatal. Early in the fifties, the idea of making a non-luminous gas-flame by mixing coal gas with a certain proportion of the air needed for its combustion before burning, led Bunsen to enrich the gas industry with the burner which bears his name. The construction of the atmospheric burner really marks an epoch in the history of the industry second only to the discovery of the mantle to use with it, as it opened a field for gas for heating purposes which is now almost as important as for lighting.

Early in the eighties, the idea of the incandescent mantle again came to the front; and the Clamond basket and a revival of the platinum mantle paved the way to the discoveries of Welsbach, which were destined to revolutionize our methods of gas lighting, and even gas manufacture. Welsbach was at that time studying the reactions and separations of the rare earths in which spectroscopic determinations play an important part; and, desiring to obtain a greater illuminating effect than was produced by placing some of the material on platinum wire, he tried the effect of impregnating cotton with a solution of the metallic salt, and then burning it in a bunsen flame, when he found the organic matter burnt away and left a perfect image of the cotton fabric composed of oxides of the metal taken, and that this oxide skeleton glowed brightly in the flame—this being especially the case with lanthania, which emitted so much light that the idea entered his mind of using a cotton fabric impregnated with a salt of lanthanum for practical lighting. This, however, proved a failure, as the oxide absorbed moisture and carbon dioxide from the air, and rapidly crumbled away. A mantle of magnesia and lanthania was then

tried; but though it gave a good light, it soon became fused and glassy on the surface, and the light, given diminished very rapidly. Zirconia in admixture with some of the rare earths was next tried, and better results obtained, as a consequence of which the 1885 patent was taken out.

Continuing his experiments, Welsbach found that the oxide of the metal thorium—thoria—when added to other oxides of the rare earths, brought up their light-giving power and also added to the strength of the mantle; but though the use of thoria was protected by the 1886 patent, the mantles were so unsatisfactory that no success was achieved with them, and no uniformity of result could be obtained. For several years, it looked as if incandescent mantle lighting was to be a dismal failure; but then Welsbach made a research upon thoria, and found that the more he purified it the less light did mantles made with it give. Finally he came to the great discovery that it was an admixture of a trace of ceria with the thoria which endowed it with its wonderful power of emitting light. This led to the adoption in 1892 of the mixture of 99 per cent. thoria and 1 per cent. ceria—a mixture which the thousands of attempts that have since been made have failed to improve upon.

The oxides to be used in the form of mantles must have certain qualifications which are very difficult to find; hence the number useable is very limited. The oxide must be unaffected by atmospheric influences, must be sufficiently refractory not to melt or even seriously soften at the temperature of the flame, and must be non-volatile; while during the conversion by the process of burning off of the nitrate-laden cotton into the oxide skeleton, shrinkage must not be excessive. These requirements are most nearly satisfied by the oxides tabulated below; and a glance at the recorded illuminating powers as given by mantles made with the commercial salts and with carefully purified salts, shows the wonderful influence in the power of emitting light which traces of foreign oxides impart to the mantles.

Light Emitted per Cubic Foot of Gas by Various Oxides.

Metals— Oxide.		Pure.		Commercial.
Zirconia		1·5	..	3·1
Thoria		0·5	..	6·0
Earth Metals—				
Cerite earths	Ceria	0·4	..	0·9
	Lanthania	—	..	6·0
Yttrite earths	Yttria	—	..	3·2
	Erbia	0·6	..	1·7
Common earths	Chromium oxide	0·4	..	0·4
	Alumina	0·6	..	0·6
Alkaline earth metals—				
Baryta		3·3	..	3·3
Strontia		5·2	..	5·5
Magnesia		5·0	..	5·0

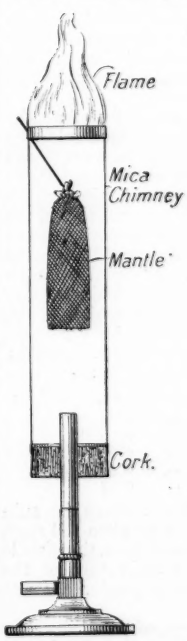
When one comes to test the oxides in this table for shrinkage, duration, and strength, one finds that three only of them are fit to be employed as what may be termed the basis of the mantle. These are zirconia, alumina, and thoria. But on making mantles with them, it is found that zirconia in the hottest part of the flame is liable to considerable and rapid shrinkage, while with alumina not only is there shrinkage and semi-fusion, but also slow volatilization, so that the life of the mantle is gradually shortened by the threads of oxides structure near the base of the mantle slowly wasting away. On the other hand, thoria practically occupies a position by itself as the ideal basis for the mantle—being readily shaped at the temperature of the blowpipe flame, and resisting the action of temperature in the atmospheric burner for a considerably longer period than any other known oxide, while in the conversion of a fabric saturated with thorium nitrate into thoria the shrinkage is smaller than with any other substance.

The factor which gives it its pre-eminence as the basis of the mantle is that, in the conversion of thorium nitrate into thorium oxide by heat, an enormous expansion takes place; the thorium oxide occupying more than ten times the volume of the nitrate taken. This, of course, means that the mass is highly spongy, and contains an enormous number of little air cells which must render it an excellent non-conductor. As already stated, a mantle made with thoria alone gives practically no light, but the power of light-emissivity in it is awakened by the addition of a small trace of ceria; and careful experiment shows that as ceria is added to it little by little, the light which the mantle emits grows greater and greater, until the ratio of 99 per cent. of thoria to 1 per cent. of ceria is reached, when the maximum illuminating effect is obtained, and that the further addition of ceria causes this to gradually become less, until, when some 10 per cent. of ceria has been added, the light given by the mantle is again almost inappreciable. When cerium nitrate is converted by heat into cerium oxide, the expansion which takes place is practically *nil;* the ceria obtained from a gramme of the nitrate occupying about the same space as the original nitrate. The result is that although by weight the ratio of ceria to thoria is as 1 : 99, by volume it is only as 1 : 999.

We have now to see the various theories which have been put forward in order to explain the wonderful power of light-emissivity awakened by these excessively minute traces of the excitant. Early in the controversy, Dr. Drossbach ascribed the power of the mantle to some special action of the ceria in converting the heat rays into light; while Drs. Killing and Moschelles came to the conclusion that as ceria formed two oxides, the particles of ceria in the mantle, by rapid transition from one condition of oxidation to another, caused local spots of temperature due to more rapid oxidation at those points. Dr. Killing also favoured the theory of catalytic action, afterwards warmly supported by Dr. Bunte. During the last few years, Le Chatelier, Nernst and Bose, Thiele, Muthmann, Féry, White, Traver, Russell, and others, have done an infinite amount of work upon the subject; while Drossbach, Killing, and Bunte have again attacked it from altered points of view.

The theory which always appealed most to me was the catalytic one, as enunciated by Dr. Bunte; and now that he has formally discarded it in favour of a theory of selective radiation, I feel more than ever inclined to champion it, as it undoubtedly plays an important part in raising the temperature of the mantle. I will not spend any time on the dual oxide of cerium theory (as, though it is the one supported by Baron Welsbach himself, I know of no satisfactory proofs that have been adduced in its favour), but will devote myself to a consideration of the catalytic theory and the more modern work on temperature and radiation.

The general definition of catalytic action in the layman's mind is that it is a convenient word to cover a class of actions which the chemist is unable otherwise to explain; but the special form of catalysis with which I wish to deal is of a less obscure order. If we take a roll of platinum foil and heat it to redness over the gauze of a bunsen burner, then extinguish the flame, and allow the current of mixed coal gas and air to flow over it before it has cooled to too low a temperature, it again commences to glow, and will remain incandescent as long as the flow of gas and air over its surface continues. This phenomenon is produced by the metal condensing hydrogen from the coal gas and oxygen from the air on its surface, and rendering them so chemically active that they combine on the surface of the metal below the ignition-point of the mixture, and emit sufficient heat to render the foil red hot. A catalytic action of this kind undoubtedly takes place with the Welsbach material. Dr. Bunte showed some years ago that ceria had the power of lowering the temperature at which hydrogen and oxygen combined, by about one-half—from 649° C. (1200° Fahr.) to 315·5° C. (600° Fahr.), and one knows an action of this description is always intensified by increase of surface in the substance action; so that in the platinum experiment, if spongy platinum instead of foil be used, it will ignite the gaseous mixture without previous heating, and the trace of finely divided ceria on the surface of the thoria in the mantle is so active that, under proper conditions, the mantle can be kept luminous in a stream of coal gas and air. Dr. Luggin first demonstrated this; and by a slight modification of his experiment it can be shown with beautiful clearness. A mica chimney is fixed over the mouth of a large bunsen burner so as to form a prolongation of the tube, and the mixture of gas and air is lighted at the mouth of the chimney; the air supply being regulated to give a non-luminous flame. An ordinary Welsbach mantle is then hooked by its loop on to a stout platinum wire, and is held in the burning mixture of gas and air at the mouth of the chimney, where it glows and emits light in the usual way; and on now lowering it down through the flame into the mica chimney below, it continues to incandesce in the cold current of gas and air. It is quite clear from this experiment that the catalytic vigour of the Welsbach mantle is sufficient to keep it incandescent in the mixture of gas and air without the exterior heating of the flame; and it seems impossible, therefore, to ignore this action when the mantle is rendered incandescent under ordinary conditions.



A New Experiment.

[Professor Lewes, in illustrating this experiment, said he did not think it had ever been done before in England—jocularly adding that he was rather proud of it, and was not going to let it go cheaply. Each time the mantle was lowered, by its wire support, below the flame, incandescence continued for an appreciable space of time, and then disappeared from the bottom upwards. But when the Professor cut off the air supply, directly the mantle was lowered the glowing discontinued.]

Before attempting to explain why this particular mixture of thoria and ceria, and no other, gives the highest possible illumination, it will be well to examine the other theories that were brought forward. If the Welsbach mixture were endowed with a special power of translating heat into light, proof of this ought easily to have been obtained by the way rare oxides and mixtures behave when heated out of contact with air. Dr. Bunte found that in trying this experiment there was a very small difference in the noticeable light radiation from bodies of such widely different light-emissivity as carbon, magnesia, thoria, or the mixtures used in the Welsbach mantle. In order to prove this, Bunte took a thick-walled tube of retort carbon, the walls of the middle portion of which were reduced to a thickness of 0·059 inch for a length of about 4 inches; and on passing a strong current of electricity through the retort carbon cylinder, the resistance of the thin-walled portion caused it to be soon heated up to whiteness—the

temperature attained being estimated by him to be over 1999° C. (3360° Fahr.). The tube was prevented from burning away at this highly heated point by being coated with magnesia, over which an outer wrapper of asbestos paper was pressed; and in the interior of this tube small square prisms of magnesia were placed, coated with the substance to be examined—each prism being compared side by side in the hottest portion of the tube. The conditions existing could be observed through a small sight-hole at the end of the carbon tube. By using double prisms, one of which was coated with the substance to be tested and the other with a standard substance of known composition, it was found that practically little or no difference existed between the various materials tested. This point was also confirmed by some very interesting experiments made by Mr. Swinton, in which he enclosed various mantle materials in a vacuum tube and submitted them to cathode rays, by which a very high temperature can be obtained, capable of raising finely-divided carbon to incandescence and fusing platinum into glass. Using mantles made of small squares of ceria and thoria alone, and mixed in varying proportion, he found that, though the mixture of 99 per cent. of thoria and 1 per cent. of ceria, heated up to incandescence in a vacuum more rapidly than pure thoria alone, and on stopping the discharge cooled down more rapidly, its incandescence was only very slightly greater than that of the thoria alone. It is clear that either Bunte and Swinton were in error in their observed results, or else that the idea of the Welsbach mantle having any peculiar power of converting heat rays into light must be discarded, as otherwise the same differences would have been noted when the materials were heated out of contact with air as is shown in the flame.

In 1896, Le Chatelier and Boudouard published a paper in the "Comptes Rendus" in which they claim that the luminosity of mantles may be explained by the ordinary laws of radiation; and from data obtained by heating a flattened thermo-couple coated with various oxides, and noticing the radiations as compared with those given by melting platinum as unity, they conclude that the substance of the mantle possesses at its working temperature an unequal emissive power for the different kinds of rays. It is therefore to be regarded as at that temperature a coloured body. Its useful incandescence results from the fact that its very high emissivity, near to unity for blue, green, and yellow rays, is less for the red, and doubtless still more feeble for the ultra-red. The proportion of energy radiated as visible rays is consequently very high; but nevertheless the absolute amount of energy radiated as light is smaller than that which would be diffused by a black body raised to the same temperature. But a black body heated under the same conditions, and with the same area of radiating surface, would attain only a very much lower temperature, and would also have only a very low illuminating power.

In 1900, Professors Nernst and Bose also concluded that the high illuminating value of the mantle could be explained solely by selective radiation of the Welsbach mixture at the temperature of the bunsen flame; and in order to ascertain whether the flame gases have any specific effect upon the emission of light by a Welsbach mantle, the two experimenters endeavoured to find out whether there was any difference between the radiations from a Welsbach mantle fibre heated in the usual way and those from a smaller fibre heated by an electric current. At equal temperatures, the radiations were found to be almost identical with thin fibres. Thicker rods brought about differences which could, however, be simply explained through the heating by the flame being from without, while that by the current was from within. The subjoined table gives the data of this comparison :—

Wave Lengths.	Flame Heating.	Electric Heating.	Ratio.
688 ..	0·770 ..	0·790 ..	1·03
589 ..	1·000 ..	0·987 ..	0·99
516 ..	1·360 ..	1·370 ..	0·99
477 ..	2·390 ..	2·340 ..	0·98
447 ..	4·210 ..	4·090 ..	0·97

In conclusion, they give their theory as follows: Since the substance of the mantle emits but little red light or ultra-red rays, and thus gives off but little energy in the form of heat, the mantle can therefore completely absorb the high temperature of the gas-flame, and in consequence emit a relatively greater amount of light.

In 1902, Messrs. White, Russell, and Traver, of the University of Michigan, published a paper on "The Theory of the Incandescent Mantle,"* which was supplemented later in the year by another on the same subject by White and Traver.† In these papers, they describe the experimental determination of the temperatures existing in the mantles and in the flame heating them by means of the Le Chatelier thermo-couple, and experimented with a pure thoria mantle as well as with one of the ordinary Welsbach mixture. They found that the pure thoria mantle attained a temperature of 1510° C., and had an illuminating value of 1·2 candles per cubic foot, while the Welsbach mantle only reached a temperature of 1404° C., and gave 15·7 candles per foot, which they point out is in direct contradiction to the theories of Nernst, La Chatelier, and their pupils, who hold the illumination of the mantle to be a function of temperature alone. They then repeated the experiments, using pats of ceria, thoria, and the mantle mixture, in which thermo-couples were embedded, and found that the highest temperature was attained in all experiments from pats of pure thoria, which emitted no light—a result in direct contradiction of Le Chatelier, who found that a couple coated with Welsbach mixture attained a higher temperature than one coated with thoria alone; and it was upon this that he based his theory. The authors conclude that the exceptional efficiency of the Welsbach mixture is due to a solid solution of the ceria in the thoria, and that it has the power of transforming the heat of the flame into light more economically than any other substance yet known. These papers are of exceptional value on account of the care taken by the authors in proving that fair relative values of mantle temperature can be obtained by judicious use of the thermo-couple, and also for the first recognition of the fact that the thoria mantle is at a higher temperature than the Welsbach mantle. There are, however, two or three weak points in the papers; while the conclusion carefully avoids the point at which all the theorists break down—*i.e.*, why 0·5 to 1·5 per cent. of ceria, and no other proportion, should have the wonderful effect it possesses of awakening the light-giving power of the mantle.

In taking the mantle temperatures, they employ a burner intended for use with a chimney; and as the latter interferes with the manipulation of the thermo-couple, they discard the chimney. This does away with the draught round the mantle; and instead of the flame burning as it should on the surface of the mantle, it has its outer zone of combustion thrown outside the mantle. That this is so, is shown by the Welsbach mantle only giving 15·7 candles per cubic foot of gas instead of 19, as it would have done probably with a chimney on. Under these faulty conditions, they take the temperatures of the mantle and the hottest part of the flame outside it, and find the flame considerably hotter than the mantle. Realizing that the conditions are not normal, they then use forced draught, and get results of the same character; but here again the conditions are not those existing with the burner used as intended, and the soft combustion on the surface of the mantle essential for the best results would not be obtained.

Dr. Killing, in 1903, attempted to solve the problem of the mantle by measuring the relative heat radiations of pure thoria mantles and Welsbach mantles in the Junkers calorimeter, and found that the addition of 1 per cent. of ceria to a mantle increased the heat radiated by 14 per cent. He confirmed this figure by direct thermometric measurements; and he concludes from this that ceria in the Welsbach mixture displays a specific power in increasing the radiation of the mantle. In 1903, Dr. Bunte read a paper before a meeting of chemists in Berlin, in which he formally renounced the catalytic theory, and adopted the theories of Nernst and Le Chatelier on the strength of some experiments made under his direction by Dr. Eitner and Herr Schmidt. Eitner first determined the temperature at various points on the surface of a naked bunsen flame, and then, having put a Welsbach mantle on it, took the temperature at the same heights above the burner-head as those at which the temperature of the flame had been determined, and found that the flame was considerably hotter than the mantle.

Experiments in which the temperature of the atmospheric burner flame burning without a mantle are compared with the temperature of the mantle at the same heights above the burner-mouth, are absolutely fallacious and useless, for two reasons. In the first place, a simple observation of the shape of the flame and of the mantle shows at once how different they are, and that with the exception of the first few millimetres at the base the flame and mantle could not be in contact unless the presence of the mantle altered the shape of the flame to a considerable degree, which would also alter its temperature. In the second place, in all ordinary atmospheric burners the uprush of the gas in the suction tube draws in the air necessary for the primary actions which give the inner zone to the bunsen flame; and when the burner is working without a mantle, this is arranged to give as hot a flame—*i.e.*, as large a proportion of air to gas—as the structure of the burner will allow. The moment, however, that the mantle is put on, the heated structure throws a back-pressure on the current of gas and air, which in no way affects the gas (which is driven forward by the pressure in the mains at the same rate as before), but entirely acts in reducing the air supply, which at once falls by 12 to 30 per cent. in quantity, according to the burner used.

This has given rise to many fallacious ideas as to what burners are really doing as regards aëration; some high-power burners being claimed to give the full ratio of 6 of air to 1 of gas, while, in fact, the ratio is not much more than half this amount. Some years ago, I showed that the best mixture of air and gas—*i.e.*, that which gave the maximum illumination from a mantle—was, for gas of the quality of London gas, 5·25 to 1; and within the last year this has been confirmed by Herr Winkler, who gives 5·3 to 1. But such proportions are only attained where both air and gas are either under pressure or suction; and if the ratio of air is increased above this point the light from the mantle falls, unless the burner be converted into what is practically a blast blowpipe. For example, a Lucas lamp is claimed to give over 6 of air to 1 of gas, and does so if tested without a mantle; but directly it is tested with a mantle burning under normal conditions, it is found that the ratio is under 5 to 1. It is clear, therefore, that such tests as those made by Dr. Eitner are worthless as showing the relation between the temperature of the mantle and the flame, or proving that the mantle is cooler than the flame which heats it.

* See "JOURNAL," Vol. LXXIX., p. 892.

† *Ibid*, Vol. LXXX., p. 562.

Herr Schmidt made spectro-photometric investigations on thoria-ceria mixtures at various temperatures, and found that the higher the temperature the bluer becomes the light emitted by thoria; while the same thing is observed with mixtures of the two oxides all the time the ceria is below 0·5 per cent. From 0·5 to 1·5 per cent. of ceria, the red rays and illuminating power increase; but beyond this percentage the colour approaches nearer to pure ceria, and the illuminating power decreases. These two sets of experiments led Dr. Bunte to adopt the theory that the lighting effect of the mantle is mainly a consequence of its selective radiation, and to discard his previous belief in catalytic action, owing to Eitner's experiments showing the mantle to be cooler than the flame.

Certainly one of the most valuable and complete researches on the mantle is that by M. Chas. Féry published at the close of 1902; and the conclusion he arrives at is that a mantle of ceria gives no light because it has so great a power of heat radiation that it is impossible to raise its temperature sufficiently in a flame (the temperature of which is limited by the phenomena of dissociation) to endow it with the power of emitting light. When, however, the ceria is sufficiently attenuated by subdivision in a thoria mantle, it can be raised to the requisite temperature, and the light of the Welsbach mixture is the result. In 1903, M. E. Sainte-Claire Deville published some experimental results on mantles, which led him to support the theory enunciated by Féry; and last year a number of experiments were made in the laboratories at Greenwich, the general results of which I will state here, but full details of which I hope to publish shortly.

When mantles of thoria, ceria, and various mixtures of the two are made of exactly the same size and shape (which can be done by using a Buhlmann burning-off apparatus), and when these mantles are tested in a properly-regulated Kern burner so as to avoid the use of a chimney, all conditions being kept exactly the same for each, it is found that the flame only extends a millimetre or two beyond the mantle, and that the thoria and 99 per cent. thoria with 1 per cent. ceria are the only mantles that are heated to temperatures slightly higher than is found in the flame 1 mm. from the surface of the mantles. The temperatures of the mantle and flame, however, vary enormously with the character of the mantle. The following table gives the mantle temperature and flame temperature taken 6 mm. above the rim of the burner—a point at which the mantle is just free from disturbing elements, and where the maximum light is being emitted. There is also given a relative radiation value for the mantles obtained by a thermo-pile at a fixed distance from them; all the measurements being taken with every possible precaution to ensure accuracy. The thoria was not absolutely pure, containing 0·1 per cent. ceria, so that the mantle gave 3·4 candles per cubic foot of gas consumed, instead of 0·5; and this probably makes the radiation value higher and the mantle temperature lower than it would be for pure thoria.

Mantle.	Thoria, 99·9 p. ct. Ceria, 0·1 p. ct.	Thoria, 99 p. ct. Ceria, 1 p. ct.	Thoria, 90 p. ct. Ceria, 10 p. ct.	Ceria.
Temperature of mantle 6 mm. above burner rim	1610 ..	1570 ..	1335 ..	1125
Temperature of flame 1 mm. from mantle in same spot .	1590 ..	1560 ..	1350 ..	1130
Average temperature up to height of 52 mm. from burner	1468 ..	1441 ..	1209 ..	1020
Average temperature of flame over same zone	1430 ..	1439 ..	1234 ..	1032
Illuminating power, candles per cubic foot of gas	3·4 ..	20·0 ..	3·3 ..	Nil
Radiation value	140 ..	152 ..	218 ..	234

The conclusions which appear to me clear from these figures and the various experiments I have described, are that the thoria, owing to its non-conductivity due to its porous condition, its low specific heat, and low radiation power for heat, can be heated to the temperature of the flame, while catalytic action on the still unburnt flame-gases and air raise it a few degrees even above this point. Ceria, when added in quantities up to 1·5 per cent. by weight or 0·15 per cent. by volume, does not interfere with these conditions, but by its still higher catalytic power tends to focus the combustion of the extremely attenuated combustible constituents of the flame-gases on the widely distributed ceria particles, and by this localization raise them to a far higher temperature than the mantle—a temperature, however, which cannot be detected by the thermo-couple, which only gives the average temperature of the mass with which it is in contact, and fails to show the temperature of the 0·15 per cent. of ceria. Addition of more ceria to the mixture causes such a rapid cooling of both mantle and flame by radiation, that the light at once begins to fall; and by the time 10 per cent. of ceria is in the mixture, the mantle gives us no more light than a thoria mantle, but a much increased heat radiation.

As to the portion of the spectrum to which the light waves emitted by the ceria at the temperature attained by the finely divided particles in the mantle belong, I have no personal knowledge, and am quite prepared to accept the evidence adduced by Le Chatelier, Nernst, Schmidt, and others, in which case catalysis, temperature, and selective radiation all play their part in bringing about that wonderful light emissivity which has made the incandescent mantle the saviour of the gas industry.

Mr. WALDRAM said it was a most pleasing duty, but an almost impossible task to adequately perform, to express the thanks of the meeting to Professor Lewes for the excellent and instructive entertainment he had given them that evening. British engineering was particularly rich in having many lecturers who were able, without notes and that sort of thing, to give excellent expositions. Nobody had ever heard, or was likely to hear, such a difficult subject as they had had that night expounded to them, with greater spontaneity and lucidity, for over two hours, and without a dull moment. They were extremely grateful to Professor Lewes; and he had much pleasure in proposing the passing of a cordial vote of thanks.

Mr. ALLINGHAM having seconded the motion,

The CHAIRMAN (Mr. Samuel Cutler, jun.) added his appreciation of the able and interesting lecture. It had excited their admiration, as did all Professor Lewes's work in the gas engineering world with which he (Mr. Cutler) had the honour of being connected. The members had looked forward to this lecture for a long time; and, by way of preparation for it, the Council arranged some few weeks ago for a visit of the members to the great International Gas Exhibition at Earl's Court, where they saw the finest display of incandescent gas lighting that anybody had ever had the privilege of witnessing. In addition to this, the Council were able, through the kindness of the Directors of the Voelker Mantle Company, to arrange for a visit, on the previous Saturday, to the Voelker works, where the processes involved in mantle making were seen. Those members who took part in the visit would have been able to better appreciate the lecture than they would have been otherwise. He thoroughly endorsed all that had been said, by both the proposer and seconder of the vote, regarding Professor Lewes and the brilliant lecture to which they had been privileged to listen.

Professor LEWES, in his acknowledgment, replied to a question by Mr. Allingham as to whether all mantles contained 99 per cent. of thoria and 1 per cent. of ceria. He said all he could say regarding this matter was that, when the Welsbach Company adopted their new and successful method of not troubling their heads about infringers and attending to their own business, at first the infringers went out of their way to make a solution which varied in some respect from the 99 per cent. of thoria and 1 per cent. of ceria, with, it was discovered by those who used the mantles, disastrous results to the illuminating power. He had never known a successful mantle that did not contain the 99 per cent. of thoria and 1 per cent. of ceria. Answering a further question, he said that, in the last six or seven years, many attempts had been made to produce a good incandescent oil-lamp. A petroleum lamp could be made which would burn oil in the same way that an atmospheric burner burned gas, and which would give a non-luminous flame. All the time they could get the flow of air and oil to the flame exactly regular, the lamp would give a very good light indeed. But it was found that the slightest inequality of the wick which was sucking up the oil to the flame, or the slightest alteration of the air currents around it, or any one of half-a-dozen other factors, would upset the arrangement of the oil vapour and air burning in the mantle; then blacking of the mantle followed, and a bad light. He had had probably fifty or sixty of these lamps confided to his tender mercies; but he had never yet had one that was really successful. He had one some years ago, in which, by means of a little dual burner, oil vapour and steam were used; the steam being made in a separate vessel. This was by far the nearest approach to a successful oil-lamp that he had ever seen. An incandescent petrol lamp which was now being made also gave a very fair light indeed. But every one of these incandescent oil-burners required very careful adjustment and watching, if good and constant results were to be obtained.

The attendance of members on this occasion will rank among the largest of the meetings ever held by the Institution at the Westminster Palace Hotel.

Labour Questions in the United States.—We learn from a correspondent that there was a decided improvement in the labour situation in the United States last year. The Courts in numerous cases ruled in favour of the individual, where an appeal was made from the tyranny of the Trade Unions. Our correspondent adds that there is still much to be done; but the principle of the open shop and the freedom of the individual has been sustained. This, at all events, is something to be thankful for.

The Bordeaux Gas-Works Competition.—It may possibly be remembered that, in the "JOURNAL" for the 9th of August last, we gave particulars of the conditions laid down by the Bordeaux Gas Company in their invitation for competitive designs for new works. For the best of the schemes submitted, three premiums—one of 300 frs. and two of 500 frs.—were to be awarded. It is interesting to learn that West's Gas Improvement Company, Limited, have secured one of the first prizes for the plans of a complete gas-works sent in by them.

Institution of Civil Engineers.—The transfer of Mr. D. Irving, the President of the Institution of Gas Engineers, from the class of associate members to that of members of the first-named Institution (already notified in the "JOURNAL") was announced at the ordinary meeting last Tuesday; and we are pleased to find among the names of the other transferred associate members that of Mr. Harry Townsend, of Wakefield. Among the new members elected at the usual monthly ballot was Mr. Alexander Wilson, the Chief Engineer of the Glasgow Corporation Gas Department.

COKE HANDLING PLANT AT THE ROSSENDALE UNION GAS-WORKS.

During the past year important extensions have been made at the Cloughfold Gas-Works of the Rossendale Union Gas Company. The remodelling of the carbonizing plant consists of a complete new retort-house of inclined retorts, built on the site of the old house, which had been taxed to its utmost capacity. One of the special features in this installation is the complete arrangement of plant for conveying the coke from the retort-house to the two coke yards, and a set of storage hoppers, of 100 tons capacity, which are arranged for loading railway waggons and carts.

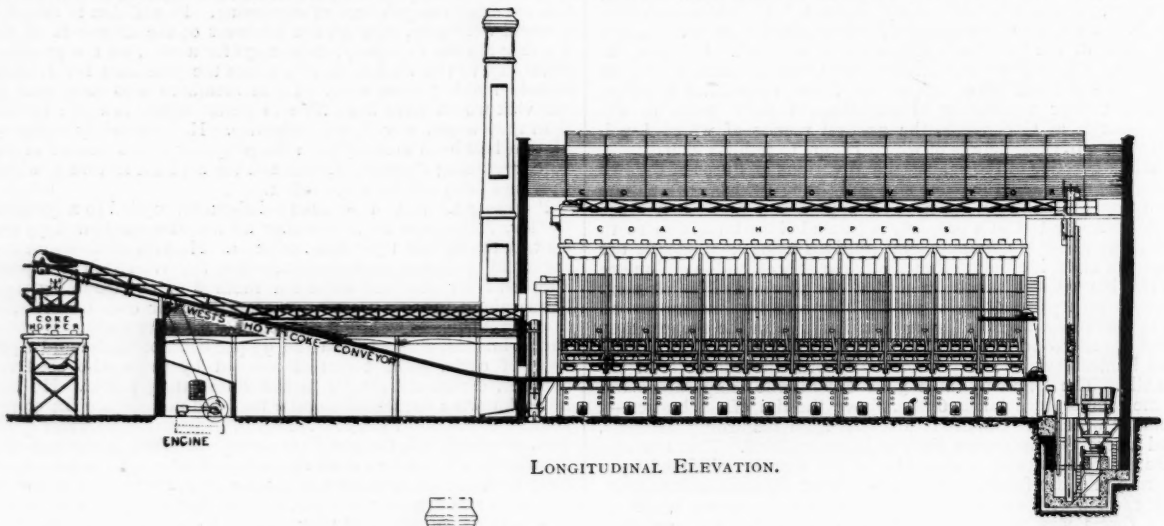
The accompanying illustrations show a longitudinal section, end view, and general plan of the retort-house and coke-handling plants.

From the retorts, the coke falls direct into one of West's patent hot-coke conveyors fixed in front of the retort-bench. The type of chain fitted to this and the other conveyors in connection with the plant is of the same design as was exhibited by the makers at the recent Earl's Court Exhibition.

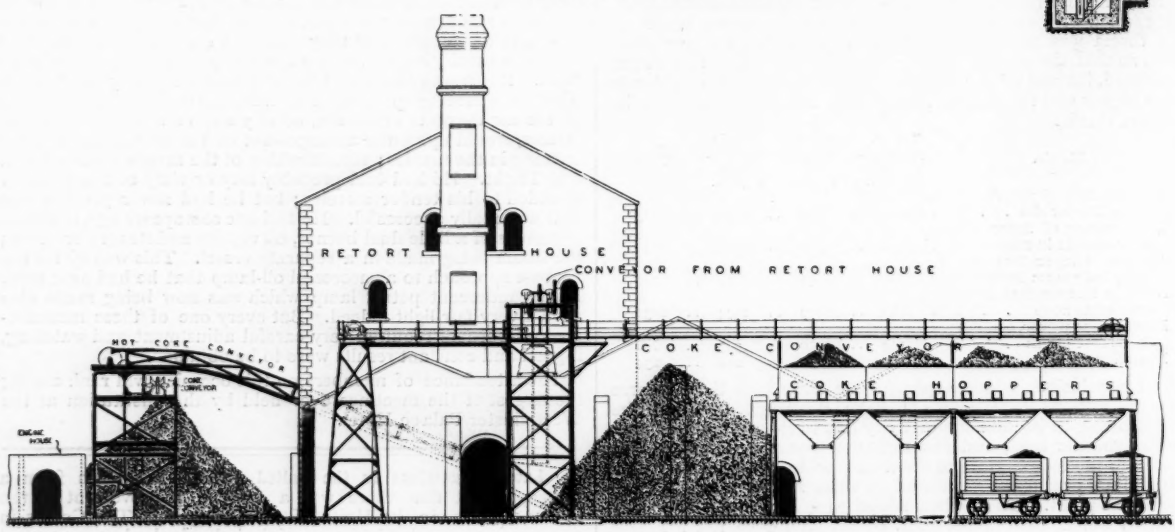
The longitudinal conveyor in the retort-house is 230 feet long, and rises after leaving the retort-house to enable it to deliver on to a reversible cross conveyor, 130 feet long, for filling the coke hoppers and yard; arrangements being made for effectively screening the coke before it is delivered into the hoppers.

About midway along the length of the retort-house conveyor, the coke can, when required, be delivered on to an inclined conveyor at right angles to the retort-house, which conveys the coke to an overhead coke conveyor in the second coke yard, which is parallel with the retort-house. These conveyors are, respectively, 85 feet and 110 feet long.

The whole plant has been successfully carried out by West's Gas Improvement Company, of Manchester, under the direction of Mr. James Riley, the Secretary and Manager of the Gas Company.



Longitudinal Elevation.



End Elevation.

SCOTTISH JUNIOR GAS ASSOCIATION.

Western District.

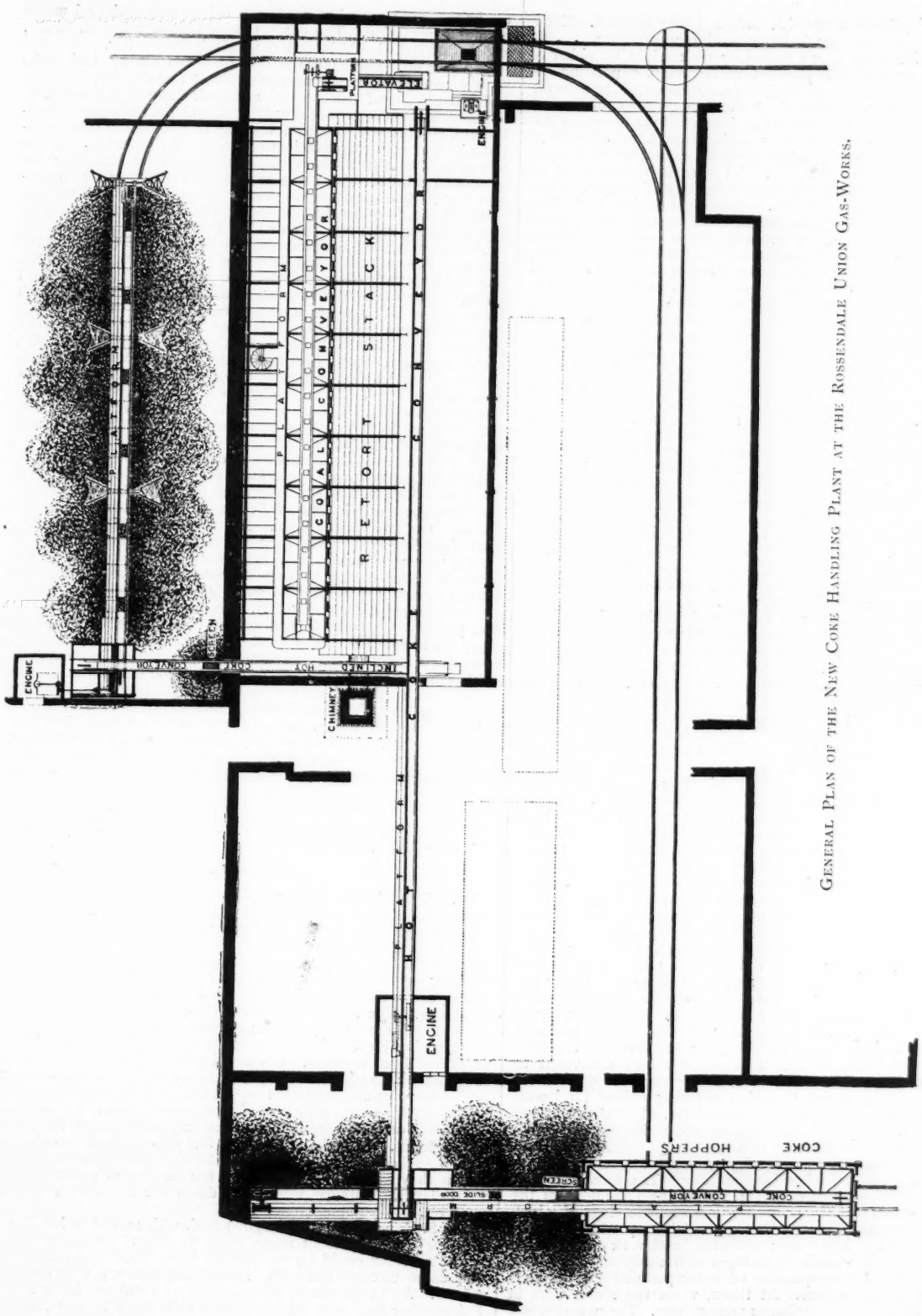
A Meeting of the Scottish Junior Gas Association, Western District, was held in the Technical College, Bath Street, Glasgow, on Saturday evening—Mr. James Lowe (the President) in the chair. There was a good attendance.

The President explained that, as the members were aware, Mr. J. Barber was unable to be present, and the paper by Mr. C. Fairweather, of Kilmarnock, was the next on their syllabus.

Mr. Fairweather accordingly read his paper.

NOTES ON CONSTRUCTION OF GASHOLDER TANKS.

Mr. C. Fairweather, Joint Manager of the Kilmarnock Corporation Gas-Works, read a paper with the above title. He said that at first he intended his communication to be simply a collection of notes, which he thought might be of interest to the members; but as he got further into the subject, he seemed to get beyond the scope of his original intention, and the nature of the paper rather belied the title, in so far as the notes seemed to have straggled into a position in the rear. There always came a time when the extension of the storage plant forced itself to the front, whether managers and directors would or would not. If the public wanted gas, they would have it; and woe betide the directors and managers who tried to save themselves by coddling the pressure. In modern storage appliances, they had improved necessarily on the designs of their forefathers. The large plants they saw to-day were what might be called the results of evolution, and when they compared the ancestors of the gasholder race with the prodigious growth of to-day, they were amazed. The original design of the gasholder was rectangular; and in many cases the holders were placed inside very substantial buildings. A building was now in use in Kilmarnock as a purifier-house which was originally built to hold two gasholders, each 30 feet diameter. It was the desire to economize space and save expense in supplying public demand which had driven engineers to erect these enormous gasholders, which were so huge both horizontally and vertically. It was note-



General Plan of the New Coke Handling Plant at the Rossendale Union Gas-Works.

worthy to observe that, while they had added much to the original design and detail as laid down by the men who founded the gas industry, they were still guided by the same sound principles which they framed. While they had elaborated their designs, they still adhered to their methods. In his work, published in 1853, Mr. Samuel Hughes stated that when a deputation from the Royal Society, with Sir Samuel Banks at their head, visited the gas-works of the Chartered Company, about the year 1814, they strongly recommended the Government to restrict the Company from constructing gasholders exceeding 6000 cubic feet capacity, to be confined in very strong buildings.

He had been trying to trace the circumstances bearing on the development of the gasholder. With it, of course, was bound up the development of the gasholder tank. The two went together. Whether the gasholder were 6000 cubic feet capacity or 6 million, it required a tank of suitable size; and the gradual evolution of the tank to its present dimensions had been a process requiring engineering skill and constructive capacity. They were all struck by the commanding proportions of large gasholders; but it was only the man who knew who realized that probably it was the construction of the tank which taxed the resources of the engineer and called forth the best that was in him. Unfortunately, when it was well constructed and finished as a work which a man might very well feel proud of, its part in the economy of things was to be filled with water, covered up, and practically put away where no one could see it. That it did seem to object to this treatment at times, they all knew; and a leaky tank was like a bad tooth—they might not see it, but they knew it was there, and it could give a

manager a very lively time of it before it was soothed. Even then there was sometimes a feeling of real uncertainty.

The work of constructing a gasholder tank might be either a very easy or an extremely difficult undertaking, depending altogether upon the nature of the site, the character of the subsoil, or the presence in the ground of water. The character of the soil at once, of course, affected the determination of the nature of the tank to be adopted—whether it was to be of brick, concrete, iron, or steel. The ground should invariably be examined (if it were not already known) by means of trial pits, or boreholes, as so much depended upon a clear conception of the difficulties which had to be met with and overcome. The cost of the job would also be favourably affected by the utmost care in these preliminary operations; the work would go on better during construction, and in the end it had every chance of being of the highest quality. These were all essential factors, which together ensured successful completion; and if the engineer had any doubts of the soil, £50 was well spent in boring and examining. He was speaking more of the difficulties to be looked for with built tanks—whether running sand might be met with, whether soft pockets existed, rock or other hard material requiring blasting; also the methods to be adopted for supporting the sides of excavations; if water was lying in the ground, and its level; the nature and bulk of the material to be excavated, and if it might be utilized as aggregate for concrete. These were all conditions which, if unknown, might adversely affect the cost of the work, but which, if known, would lend themselves as circumstances might direct, to help on the job to a successful completion. Boreholes must be both numerous and deep. They must be numerous, because it was surprising to find the variations of level which given strata might exhibit, over even a small area. They must be deep in order to make sure that the walls were placed on foundations which were secure and solid. In exceedingly bad foundations, recourse might be had to piling, which was very expensive, and demanded the best possible knowledge of the material to be dealt with so as to determine the length of piles necessary.

If, on boring the land, it were found inadvisable to adopt a built tank, and preferable to put in either a steel or cast-iron one, at or near the ground level, boring would indicate the most advantageous level which was to be had. It might be, and sometimes was, the case that no excavation was necessary, but that the upper crust of the earth, at the particular place, was the best foundation to be had; and at the same time, the engineer would be guided as to the necessity of piling, and generally making secure against settlement, the concrete raft on which the steel or iron tank was to be placed. A built tank might be entirely of brick, and, in some cases, wholly of concrete. A good deal depended upon which material would come in cheapest. He had found a composite tank to work out very cheaply, and to be a most satisfactory job on completion. One of the main reasons why this form of tank was adopted in Kilmarnock was because they were excavating in a gravel bed, and found all the aggregate and sand required, washed and ready, as well as water, and as much puddle clay as they wanted, under the gravel. The only trouble experienced was the overflowing of rivers on both sides of the excavation, and the possibility of excessive pumping operations. On boring, they found a depth of surface sandy soil, varying from 1 ft. 6 in. to 3 ft.; under the soil was a layer of sand and gravel, varying in thickness from 11 to 19 feet; and under the gravel they found clay and stones for a considerable depth, until it gradually merged into a soft bastard rock. The water lay at the level of the rivers, and rose and fell with them. The clay occurred at a convenient level for the foundations of the tank walls; and at the same time sufficient could be excavated to puddle behind the walls.

Their first business was to sink a pumping well at the lowest point of ground, in order to collect the water, which they pumped into the river. The well was sunk by under-digging, and building on top. The well was sunk to a depth of 30 feet from the field level. It was 6 feet in diameter, had 9-inch walls, and was supported on a circular timber bevelled ring. The foundations of the tank walls were of concrete, as was also the floor of the tank. The walls were built up of two concentric rings of 9-inch brickwork, with the intermediate space filled up with concrete, thoroughly worked into place; while the brickwork was grouted each course. The walls were finished with a concrete cope, cast in place. The average quantity of water pumped out per hour was about 10,000 gallons. At times, when the rivers were in flood, this quantity rose to about 15,000 gallons. The pumping was done by means of pulsometers, which were found to be convenient and satisfactory. When due time had elapsed to allow the concrete to set, the water in the ground outside was allowed to rise, and thus they had a test of the tank walls before the water was put inside. They found that they had a thoroughly satisfactory job, with no leakage, and with, consequently, nothing to fear on that score afterwards. The filling of the tank with water was a severe test. They pumped it from the well into the tank—thus draining the land outside, and leaving only the earth backing to resist the pressure from the inside. Even this severe test was successfully withstood; and ever since the tank was filled, twenty months ago, storm water had overflowed as it fell. The bricks used in such work must be close, even, and well burned, free from cracks, and well made, in order to lie on their natural beds; and too much attention could not be given to their quality, having in view the importance of the work. The same care must be exercised in the bricklaying; none but good men being employed, and under careful supervision. The cement should be of a known brand, and each batch should be tested regularly for quality.

The principal advantages arising from the use of steel tanks were convenience in placing them to suit foundations, lightness and convenience of construction, and their comparative elasticity under partial settlement of foundations. Under ordinary circumstances, all that was wanted in the way of foundation was a concrete bed, or raft, of a sufficient size to carry the weight. It was advisable that the whole of the tank should be accessible for periodical painting, which was most important, in order to prevent rust. A layer of sand should always be placed on the concrete bed, in order that the thin bottom plates might take an equal bearing when the tank was filled with water.

The same general conditions could also be said to hold in the case of cast-iron tanks; but they might be sunk in the ground, and did not suffer from corrosion in the same degree as steel tanks. Sometimes, however, cast-iron tanks gave trouble through faulty plates, which might have passed unnoticed in the testing, and afterwards broke when the load came on them—thereby giving a great deal of trouble. Settlement of foundations also told much more on cast-iron tanks, and fractures were then sure to take place. Painting, however, was not so essential as with steel tanks; but it was advisable to keep the metal protected wherever possible. There was also the possibility of more trouble from leakage in the case of cast-iron tanks, as the plates were bolted up with rust joints.

He had collected the cost of three different forms of tanks, and gave three examples of each, from small up to moderate size. No. 1 (steel), 73 ft. 6 in. diameter, cost £1150 for steel work, £180 for foundation, and a total of £15·10 per 1000 cubic feet of tank space. The gravel was used. No. 2 (steel), 63 feet diameter, cost £850 for steel work, £395 for foundation, and a total of £20·96 per 1000 cubic feet. The foundation was costly; the whole material having to be removed. No. 3 (steel), 104 feet diameter, cost £2520 for steel work, £600 for foundation, and a total of £11·97 per 1000 cubic feet. The foundation was excavated. No. 4 (cast iron), 69 ft. 6 in. diameter, cost £1450 for ironwork, £350 for foundation, and a total of £23·14 per 1000 cubic feet. No. 5 (cast iron), 82 feet diameter, cost £2266 for ironwork, £400 for foundation, and a total of £19·79 per 1000 cubic feet. No. 6 (cast iron), 104 feet diameter, cost £4000 for ironwork, £550 for foundation, and £17·46 per 1000 cubic feet. No. 7 (brick and concrete), 62 feet diameter, cost £1300, and a total of £20·75 per 1000 cubic feet. No. 8 (brick and concrete), 101 ft. 6 in. diameter, cost £2672, and a total of £10·75 per 1000 cubic feet. No. 9 (brick and concrete), 122 feet diameter, cost £4600, and a total of £12·79 per 1000 cubic feet. The depths of the tanks were: No. 1, 26 ft. 9 in.; No. 2, 18 ft. 9 in.; No. 3, 30 ft. 8 in.; No. 4, 20 ft. 6 in.; No. 5, 25 ft. 6 in.; No. 6, 30 ft. 8 in.; No. 7, 20 ft. 9 in.; and Nos. 8 and 9, 30 ft. 9 in.

Discussion.

Mr. W. A. White (Falkirk) said that one of the points in the paper which had struck him was that in which Mr. Fairweather spoke of a gas tank having been put down 20 feet into the ground. Could a local authority compel this to be done? Had they any jurisdiction over a gas company's plans, if there were parliamentary sanction for them? He did not think they had. The raising of the tank-wall above the level of the ground was a very good idea. The Kilmarnock gasholder was put to a severe test. He knew of a case in which an engineer stopped pumping; and one morning he found the bottom of the tank forced up about 18 inches from beneath. It was all very well to dig a passage round a tank, and fill it in with pitch, if the tank were a shallow one; but he knew of a case where they went down to a depth of 22 feet, and he could not see how it would have done there. In the case of a brick or steel tank, the local circumstances must be taken into account. In tanks of 60 or 70 feet diameter, steel tanks, as a rule, worked out much cheaper, if the foundations were suitable. When they came to a larger size, the excavated material, if it were clay, for instance, would run down the cost of the tank a good bit.

Mr. S. B. Langlands (Glasgow) said, with regard to Mr. Fairweather's remark about negotiations having to be entered into before a holder could be erected, he knew about it, because he had come through the mill. It was sometimes a very difficult matter. As to the shape of gasholders, he did not know if Mr. Fairweather had seen an interesting little book by one Accum, published about 1815, wherein was shown a holder of rectangular shape, which was attached to the chimney. As to boring the subsoil, they could not always be sure, even after they had bored, as to what they might come upon. In a case of a 72-feet diameter tank, the bores showed sand and very good clay; and after they had got down to a depth of 20 feet, they came upon a spring of water which caused immense trouble to divert. He had one instance in which the ground was so bad that it would not take piles; but they were obliged to put the holder down upon this particular spot. He enlarged the area of the raft, and put in expanded metal; and he was glad to say he was successful. He would have liked if Mr. Fairweather had told them whether the excavating was done by steam or by hand; and information as to the preparing of the puddle was always interesting. The author dwelt too much upon the corrosion of steel tanks. As he said, it was only at the junction of wind and water that corrosion occurred;

but, if packed with good sand, or with clay, he did not think there was any more reason to fear rust there than in the inside of a holder. The annular space round the tank seemed to him to be a very expensive method. Cast-iron tanks were going out of date, at which he was not sorry. A better way to put them up was to plane the joints, instead of making a rust joint. The comparative costs given impressed him very much in favour of steel tanks, up to a certain diameter. He would also like to know the thickness of the raft he put under steel tanks.

Mr. A. H. WHITELAW (Glasgow) remarked that the figures in the paper pointed clearly to the fact that cast-iron tanks did not hold their own with either steel or brick and concrete tanks.

Mr. R. C. CAMPBELL (Glasgow) expressed a wish that Mr. Fairweather would tell them, with reference to No. 9, whether the £4600 was the total cost of the tank, including (say) guide-rails, bearing-stones, &c.

Mr. FAIRWEATHER said the cost included the tank, the guides, the inlet and outlet U-pipes—everything to complete the tank ready for the gasholder structure going above it.

Mr. CAMPBELL said in his opinion £4600 was a very low figure, for the size of the tank; and the people of Kilmarnock had got a bargain.

The PRESIDENT said many of the members would no doubt have noticed that the Technical Press advocated brevity in the papers to be read before the Scottish Junior Gas Association. Brevity undoubtedly had its advantages, in certain cases; but in the present instance the Association would have been poorer had Mr. Fairweather seen fit to curtail his remarks in any way. Probably the subject he had chosen to address them upon showed the expansion of the gas industry more than any other—how the tanks which about the year 1830 were only of 6000 cubic feet capacity, had now reached 12 million cubic feet; and there were projects for even greater erections in the United States. The Kilmarnock tank, which Mr. Fairweather had described, was certainly a very cheap piece of work for the Corporation. There were one or two points of great interest in the tank, such as the nature of the soil in which it was built, and the bed of clay which ran across the lower part of it. In most cases there was danger of leakage; but with the Kilmarnock tank this had been entirely avoided. He thought the treatment of the clay was a most noteworthy feature in the construction of the tank, because usually, after a tank was completed, especially if it was a large one, there were a great many cracks in the bottom; and where water came in it would run out, causing trouble, to say nothing of the cost of replacing the water. Another point which struck him as being interesting was the method employed to sink the well. In his opinion, Mr. Langland's method of using concrete and expanded metal to make a sufficient bed to build a steel tank upon would, in some soils, be a matter of considerable difficulty. He had much pleasure in asking the members to give a hearty vote of thanks to Mr. Fairweather.

Mr. FAIRWEATHER returned thanks. Dealing with the points which had been raised, he said that while he would not like to make any definite statement as to whether or not local authorities had a controlling power over gas companies, in this particular case they certainly did have a say, and a very considerable one, in so far as the Company had some work to go on with later in which the Local Authority might have an inconvenient word; and, altogether, the Company considered it better, in their own interest, to accede to the request of the Local Authority, rather than fight them. The question arose on the opinion of the Borough Surveyor, who considered that a steel tank, if it were placed on the ground level, would be in danger of being blown over, or he had some idea of that sort. He would not sink a steel tank 22 feet. In anything he had done, the excavations had been shallow, and the pitch filling had not been greater than 2 feet or 2 ft. 6 in. in depth. He did not think he would put a steel tank down 20 feet. In the excavation, they employed three steam-cranes, ranged round the outside of the pit. By these the buckets were raised and swung round, and the excavated material was laid down to make up the ground. When they took out the clay, they kept it in water, and with the exception that the stones were removed, it was put in in the shape of puddle behind the wall in practically the same condition as it was taken out. What led him to make the remarks he did about the corrosion of steel tanks was that, in many cases, the owners did not pay much attention to the painting of them. But this was a fallacy. There was no mistake that with steel—not so much with iron—the metal required protection. Though the tank plates were thicker than the holder plates, they needed attention; and while the holder was painted every year, the tank should be painted at least once every two years. The size of the concrete raft depended a good deal upon the nature of the subsoil. If it was a good weight-carrying one, it would almost be sufficient if the surface were skinned over; but with other material, such as sand, it would be better to make it thicker. He had put in such foundations from 9 to 15 inches thick, and had found the latter to be sufficient with any soil. He had never used expanded metal. To the President's remarks about the clay, he might explain that when they had built the wall to the height of the upper surface of the clay, they rammed clay in behind the wall, and thus corked out the water—preventing it from getting down behind and below the wall, and into the tank, which would have given them trouble. In constructing the well in the way they did, the great point was to keep the excavation plumb, because if it got off the plumb the brickwork would not sink. But if due attention were paid to this, it was a very simple method of sinking a well, and it was not nearly so costly as digging the whole well and timbering it.

ECONOMY IN RELATION TO GAS DISTRIBUTION.

This was the subject of a paper which was read by Mr. David Ure, of Glasgow. In the course of it, he said that the paramount thought in the minds of everyone should be to study practical economy in all departments of gas distribution, with a view to increasing the number of consumers and giving cheaper gas for all. Another reason why an appeal for economy was made was on account of the large quantity of gas which filtered away, and was termed unaccounted-for gas. The following table would give some idea of the unaccounted-for gas in Glasgow:—

Year.	Cubic Feet.	Percentage on Make.	Rate.	Amount of Loss.
1899-00	569,574,870	9·500	2s. 2d.	£61,703 18 10
1900-01	646,243,500	10·550	2 6	80,780 10 0
1901-02	675,787,759	10 600	2 6	84,473 9 5
1902-03	726,802,214	11·300	2 4	84,793 12 2
1903-04	746,903,920	11·245	2 1	77,802 9 10
			Total for five years . .	£389,554 0 3

From the above, it would be seen that for every 100 cubic feet of gas made, over 11 feet were lost. The question before them was how this could be checked. In the distribution of gas, large mains were necessary; and, of course, leakages in these mains must be of frequent occurrence. A certain amount of gas must escape; and he thought that every encouragement should be given to anyone reporting a broken main, so that it might be put to rights at once. He would like to see a more general use made of the prepayment meter, as the ordinary meter often favoured the consumer, and thus helped to swell the quantity of gas unaccounted for. It might be economical to place meters upon a number of street-lamps; for escapes proceeding from the inside tubes of these were apt to be overlooked. He was sure there were many escapes in stair fittings which were not detected, and that such loss of gas might be going on for a long time. This could be obviated by placing meters on all stairs in the city, as was already done in Clydebank and other districts controlled by the Glasgow Gas Department.

He would also advocate the fitting of stopcocks upon each individual house in a tenement, the cock to be placed immediately outside the house, on the stair landing, before the service-pipe entered the premises. A fitter could then turn off the gas, in a case of "no access," without breaking plaster and destroying property. There would be economy also in this, though at present, in a great number of cases, the pipe was not only cut off inside the house, but also outside; and when a meter was refixed in the same house, a new pipe was required both inside and outside the house. He was aware that a universal system of stopcocks was in operation in Edinburgh. Instead, however, of the common stopcock, boxed in, and with a special key to open the box, he would suggest a simpler apparatus somewhat similar to those which were sometimes put on gas-stoves—he meant a lock-cock. The barrel could have a square head, for the key to fit on, and over the head a cap could be screwed on. To turn on or off the gas, it would be necessary to unscrew this cap. These suggestions, he need not say, would mean a good deal of expense at first, but, if found practicable, would, he had no doubt, pay in the end. Gas had a great future before it, as had been proved by the late Earl's Court Exhibition; and the more that economy was practised the greater would be the advances it would make. True economy, let them remember, was not concerned only with the present; it took in both present and future.

Discussion.

The PRESIDENT said Mr. Ure had tackled a thorny problem, and he hoped they would have a good discussion on the best means of minimizing the drawback of unaccounted-for gas.

Mr. R. COWIE (Glasgow) did not think that all the unaccounted-for gas in Glasgow was due to the mains. He understood that before Provan was built, the pipes in Glasgow were taxed to their utmost. The purifiers would raise the temperature of the gas to a considerable extent; and, being measured immediately afterwards, the make of gas would appear larger than it really was. In a paper by Mr. Myers, of Saltcoats, upon "Unaccounted-for Gas," he found that 75 per cent. of the loss took place in the mains, and the remaining 25 per cent. in the works. A large proportion of the unaccounted-for gas was due to the holders. Where, as in Glasgow, they were heavy, and the pressure was great, leaks became more apparent and larger; and where there were many of them—as undoubtedly there were—unaccounted-for gas increased.

Mr. W. A. WHITE (Falkirk) thought greater fault was to be found in the service-pipes than in the mains, and that there was a good deal of the leakage in connection with street-lamps. About stopcocks outside houses, the question was whether there were so many bad payers as would warrant the cost of them. He did not

think there were. In gasholders, there was bound to be an absorption by the water of some gas. He had found this to be the case by experiment. In some gas-works, no register was kept of the gas they consumed themselves. He would like information as to the rise in the unaccounted-for gas in Glasgow during recent years.

Mr. J. Byres (Glasgow) could not understand how Mr. Ure made out that the dry meter favoured the consumer, more than the prepayment meter, because the meters were identically the same. Where prepayment meters were in use, a practical man should either go along with the collector or the collector should be a practical man himself, because such things as two pennies, hairpins, and the like, were found sticking in meters. These things a practical man could put right on the spot; and, besides, he could instruct the people as to how to use the meter.

Mr. R. Shepherd (Glasgow) thought Mr. Ure had put the unaccounted-for gas in the city at a high figure. He had given them the loss at the retail price of the gas; but he did not think he would charge the department quite this price. Still, it was a serious matter, and required to be looked after. He remembered that, at one time, men were kept in Glasgow who went about trying to discover if escapes in the mains were going on; but he did not know if this was still the practice. He did not see how there could be much loss by meters. They had a staff of men going round; and if there was any apparent change in the people's consumption, they looked after that. More than this, men went round testing meters, to see that they were not giving gas for nothing. He understood that the putting of stopcocks upon houses had been tried in places around Glasgow, and that some of them had dropped the practice altogether, as they found it would not work.

Mr. Ure said he thought the prepayment meter was more attended to than the ordinary meter, just because it was a penny-in-the-slot one. He could not explain the rise in the unaccounted-for gas; but the figures he had given were taken from the books, and the loss was there.

The President believed there was something in what had been said about the temperature at which the gas was measured. Until this year, no correction was made in Glasgow to counterbalance the difference in temperature. The gas was measured usually at a higher temperature than in the consumers' houses; and, of course, this made an increased volume unaccounted for. The same thing held good with regard to pressure. The gas was measured in the station meter at a higher temperature than it probably was in most of the meters in the districts; and this would need correction also. Then, again, unaccounted-for gas included that used in the works, which, however, could not form a great proportion of the total. The subject was a very difficult and thorny one; and the figures Mr. Ure had placed before them were suggestive of the saving which might be effected. He asked them to give Mr. Ure a very hearty vote of thanks.

GAS v. ARC LAMPS FOR STREET LIGHTING.

At the Meeting of the Glasgow Section of the Institution of Electrical Engineers last Tuesday, a paper on the subject of "Street Lighting by Electric Arc Lamps" was read by Mr. H. B. Maxwell, the Burgh Electrical Engineer of Partick.

The author began by emphasizing the importance of street lighting to municipalities, and by remarking that it was one to which very little attention was given, judging by results. It was by no means rare for ratepayers to have the privilege of paying a rate, by no means negligible, for the faint glimmer obtained from occasional flat-flame gas-burners, when the lighting could be increased a hundredfold by the substitution of electric arc lamps with but a small increase in the rate. He fully realized that there were a number of small districts where arc lighting was unnecessary, and perhaps even undesirable; but in such places half-ampere Nernst lamps could effectively displace incandescent gas-lamps, both as regards economy and lighting. There were, on the other hand, numbers of towns atrociously lighted, which could largely increase their lighting, at the same or at a small additional cost, by substituting arc lamps. He wished to emphasize the fact that street lighting was not the expensive luxury it was generally deemed, even by many station engineers.

If the requirements of street lighting were carefully studied, it would be found that what was wanted was not an illuminant that most affected the eye, causing the pupil to contract so that other objects were indistinct, but one that illuminated the street and surroundings without any dazzling effect, and also one that had a maximum candle power at an angle below the horizontal. For this reason, arc lamps properly placed were infinitely superior to incandescent gas-lamps, which, owing to the concentration and intensity of their light, the necessity for placing them comparatively low down, and owing to their maximum candle power being at an angle above the horizontal, were one of the worst forms of lighting in this respect. It could undoubtedly be overcome to a large extent by placing the lamps much higher; but it was then necessary to augment the illuminating power by grouping three or four mantles together at a great increase in cost, in order to avoid the shadow cast by the pole in this form of lighting, and to provide sufficient power to efficiently light the streets at these heights. In certain streets in Partick as many as six 3-feet incandescent gas-burners had been displaced by each 12½-ampere arc, with the arc 25 feet from the road level. With the gas-lamps, there was undoubtedly plenty of light; but objects on the road between the lamps, at a distance of 100 or 150 yards, were indistinct, and in some cases quite invisible; whereas with the arc lamps similar objects were quite clear when 300 yards distant in straight streets. Surely this was the form of illuminant required for street lighting for both police and traffic purposes. The chief reason why arc lighting had not been more extensively used in streets was that station engineers did not charge rates low enough to make the light commercially practicable. Another reason was that, when a station engineer got a street or two to light, his main object seemed to be to cram as many lamps as possible into the space available, so as to increase the revenue, with no considerations of economy or of the most suitable positions of the lamps with a view to extensions.

Mr. Maxwell then went on to deal with the points that should be considered if arc lighting was to be adopted—viz., the type, position, and upkeep of the lamps, and the charge to be made per lamp per annum. On the latter point, the author said the capital cost of installing 400 10-ampere arc lamps, with poles, resistances, cables, road work, switch-gear, &c., would be about £24,000; so that the annual cost, including all charges, would be—

	Total	Per Lamp.
7 per cent. interest, sinking fund, and depreciation on £24,000	£1680 0 0	£4 4 0
Carbons—75,000 pairs, at £4 10s.	337 5 0	0 16 10
Wages—five trimmers, repair hand, and mate	455 0 0	1 2 9
Repairs, painting, &c.	100 0 0	0 5 0
672,000 units, at 1d. per unit	2800 0 0	7 0 0
	£5372 5 0	£13 8 7
	Say	13 10 0

Mr. Maxwell pointed out that the charges on capital and for current formed upwards of 80 per cent. of the total cost of the lamp, if 1d. per unit was charged for current. It was therefore to these two items that one must look for any large reduction in price, although it was essential that the others should be kept down, if cheap arc lighting was required. The 7 per cent. allowed for interest, sinking fund, and depreciation would, he said, be found more than sufficient, as the greater part of the capital outlay was for mains, feeders, poles, road-work, and labour, which depreciated very little. If the money was borrowed at 3¼ or 3½ per cent., the remaining 3¼ or 3¾ per cent. for sinking fund and depreciation was sufficient to repay the loan in less than twenty years. The question of current was the most important. The number of units allowed in the estimate was based on 3500 lighting hours per annum, which was slightly in excess of the actual lighting hours when the circuits were switched on and off from the station.

The only items that should be included in the charge for current for street lighting were the works costs exclusive of wages (which should not be increased at all by the addition of a street lighting load) and interest, sinking fund, and depreciation on the capital cost for boiler, generator, and condenser plant. The cost of all cables, feeders, and switchboards had already been debited against the capital cost of the street lighting; so that the £40 per kilowatt demanded, even after providing for a small amount of spare plant, would be more than sufficient to cover the increased cost of station plant due to the street lighting. On this sum, 8 per cent. interest, &c., would be a charge of £3 4s. per kilowatt per annum, which, at 3500 units per kilowatt per annum, worked out at 0·22d. per unit. Any other items—such as insurance or office costs—that might be increased by the addition of street lighting, would be amply provided for by 0·03d.; so that a station could supply for street lighting at the following rate: Works costs – wages + 0·25d. If considered necessary, a small addition to this price might be made for profit (every 0·1d. adding £280 to the revenue from 400 lamps); but in the author's opinion no such increase was needed, as the decreased cost per unit of coal, stores, and repairs (especially the last item), owing to the much better load-factor, would in itself cause a considerable profit. Thus, if the increased load-factor reduced these costs by only ¼d., a profit of £700 would accrue from the 672,000 street lighting units, in addition to that realized from the whole units generated from the station.

Mr. Maxwell went on to say that there were 54 stations in which the cost per unit for street lighting, if worked out on the basis given, would be from 0·57d. to 1d. per unit, and which could therefore supply 400 10-ampere street lamps at prices ranging from £10 18s. to £13 10s. per lamp per annum (everything included), and yet the town with the lowest rate had no street lighting at all. Contrasting these figures with those for incandescent gas lighting he said:

From information received from about fifty towns, the average cost per lamp per annum of incandescent gas-lamps, including gas, repairs and maintenance, wages, uniforms, &c., but providing nothing for capital charges or for buying new lamps out of revenue, is—

Single 3½ to 4 foot burners	£2 10 0
Two ,, ,,	4 10 0
Three ,, ,,	6 15 0

The candle power of these on the street after 50 hours' use will, respectively, be 40, 70, and 100 candle power. There is not the slightest

doubt that a very large number of towns can light their streets with arc lamps as cheaply as with incandescent gas, and with a large increase in light, provided the arc lamps are judiciously placed, and the whole scheme has been carefully designed.

The author then referred to Mr. Bradley's report on street lighting in Westminster,* given in an appendix to his paper, and said the average candle power of a 10-ampere arc lamp with opalescent globe was 637, which at £13 10s. per lamp per annum, worked out at 5d. per candle power per annum—a figure which could not be equalled by any other form of lighting; the average obtained from ordinary incandescent gas lighting being 1s., even when taking the nominal candle power of the mantle. Mr. Maxwell said he would be pleased to take on as many 10-ampere street lamps as he could get at £13 10s. per lamp per annum. There was not the slightest doubt that in a year's time, when condensing plant and efficient machinery had been in operation for a year with the present street lighting load, the cost figures at Partick would speak for themselves, and would compare favourably with stations with a traction supply. All station engineers would, of course, take better prices if they could get them; but if street lighting could not be obtained at a better rate, it would undoubtedly pay to supply at the rate given rather than lose so excellent a load-factor. In towns where the electricity supply was in the hands of a company, the municipality should borrow the necessary capital and maintain the lamps themselves, buying only the current, as a company were sure to protect themselves by a liberal estimate of the other items, raising the total cost of the lamp, while nominally selling current at a low rate.

The author concluded by giving a description of the arrangements made in Partick.

Mr. A. Wilson, the Chief Engineer to the Glasgow Gas Department, who was invited to take part in the discussion on the paper, said the low estimation in which the electric arc lamp for street lighting was now held by almost all public authorities, was a sufficient reason for the Institution dealing with the subject; and Mr. Maxwell was doing right in calling attention to the matter. But he (Mr. Wilson) was afraid better arguments than any the author had stated would be required to bring arc lighting into favour again. At the very beginning of his paper, Mr. Maxwell had a tilt at the old windmill of flat-flame gas-burners. This was a favourite pastime of all young electrical engineers; but, like the flat-flame burners themselves, this comparison should now be quite out of date. His statement that arc lamps, to increase the lighting one-hundredfold, could be substituted for flat-flame burners with but a small increase in the rate, was, to put it mildly, very wide of the mark, and must have been meant for home consumption only. As, however, flat-flame burners were quite behind the times from a gas engineer's point of view, it was not worth while discussing this. In the next paragraph, he said that half-ampere Nernst lamps could effectively displace incandescent gas-lamps both as regarded economy and lighting—another wild statement. It was admitted by even electrical engineers that Nernst lamps were, from their construction, quite unsuited for street lighting, without taking into consideration at all the fact that, light for light, the cost was quite three to four times that of the most ordinary form of incandescent gas lighting. Mr. Maxwell then went on to enumerate the requirements for effective street lighting, which were fairly right as far as stated, but one most important condition had been entirely omitted, no doubt because with arc lamps it was impossible to fulfil it. He referred to the necessity of having the illumination as uniform as possible over the whole street surface. As the strength of a chain was said to depend on the weakest link in it, so the true criterion of effective street lighting was the amount of light supplied to the darkest parts of the street. Alternate zones of light and darkness were most objectionable, and only served, by contrast, to make the want of light at the dark places more felt. This was very apparent with arc lighting. The author then condemned the concentration and intensity of incandescent gas-lamps. This, from an electrical engineer recommending arc lamps, was surely a case of the pot calling the kettle black—only a great deal more so. The conclusions given in the paper as to the relative values of the two systems with regard to the direction of the rays of light were not correct; but they did not count for much as, without a diffusing globe, arc lamps would be quite useless for street lighting, and a good reflector with the incandescent gas-lamps easily directed any stray rays in the direction most required. It was said that in Partick as many as six 3-feet incandescent gas-burners had been displaced by each electric arc lamp. Here he wished to thank Mr. Maxwell for his testimonial to the incandescent gas-lamps. He said that with them there was undoubtedly plenty of light; but—there was sure to be a "but"—objects on the road between the lamps at a distance of 100 or 150 yards were indistinct. What kind of lighting could be expected from lamps 200 to 300 yards apart? Then he capped his recommendations for arc lighting, and expected no doubt that everybody would at once begin to clear away the gas and put in electric arcs, as he had done, by saying that similar objects were seen quite clearly when 300 yards distant from an arc lamp in straight streets. The lighting value of a 650-candle power arc lamp at a distance of 300 yards was equal to the $\frac{8}{10000}$ part of one candle. He was afraid the moon was shining on the objects named when Mr. Maxwell made that observation. As to the financial side of the matter, the statements put forward, and the conclusions drawn, were far from being correct, and were on a par with the shopkeeper who sold eggs at 1s. per dozen, though he paid 1s. 3d. a dozen for them, and explained to a customer that it was the large quantity he sold that gave him his profit. Like the shopkeeper, Mr. Maxwell was selling his goods below cost price. If he (Mr. Wilson) wanted to regain the lighting of the Partick streets for the Gas Department, and cared to follow Mr. Maxwell's lines, he would say to his Committee: "Gentlemen, we have to keep up our undertaking, maintain the plant, keep our mains in good order, and provide all labour, office staff, &c., for all our other consumers, so it will pay us to get the extra consumption required for the street lighting of Partick. We can give them the gas for nothing, or pay them something to take it, as we shall have all the residuals from the coals used in supplying the needful quantity of gas." When these one-sided and altogether wrong views as to cost were put before, and believed no doubt by, councillors and others, without them having the chance of weighing the true facts of the case, one could quite understand why there was such an amount of arc lighting in Partick.

Referring next to the figures given in the table by Mr. Bradley, the author at once trotted out the figures from the "Total cost per candle power" column, as if these settled the whole question. He also took the cost of the arc lamp at the low and, in his (the speaker's) opinion, unfair figure given for Partick; while he was content to take the average of about fifty towns for the cost of the incandescent gas-lamp, instead of the local figures. The well-known law of inverse squares for the calculating of lighting values could scarcely be ignored in a comparison of lights such as this. Taking the figures given in the paper—he did not accept them as correct, but to save trouble he would use them—for the arc lamp (say) 650 candles and for the incandescent gas (say) 40 candles, and also that one arc displaced six gas-lamps, he had prepared a diagram which showed that the illumination supplied by the arc lamps was concentrated near them, leaving the middle distance in comparative darkness; while with incandescent gas, the illumination was fairly equal throughout. It also showed that for this middle distance, which was the true test of good lighting, when Mr. Maxwell displaced the six incandescent gas-lamps, and put in one arc lamp in their place, he reduced the effective illumination by more than one-half. The cost of the incandescent gas-lamps using 3 cubic feet per hour for (say) 3600 hours, as obtained from the Glasgow Lighting Inspector that day, was—

Gas	£1	2	6	
Renewals	0	1	9	
Wages	0	13	0	
Total	£1	17	3	per lamp,
or	£11	3	6	for the six lamps.

For 80-candle incandescent gas-lamps the cost per year in Glasgow was £2 5s. 6d. The price of the gas taken was its true commercial value; and the wages included cost of uniform, holidays, &c. So that even taking the most favourable figures for the electric arc lamps, they only obtained half the lighting value, with a considerable increase in price. This was a comparison with the cheapest form of incandescent gas-burners, at an electrical engineer's estimate of their candle power. If he were to make the comparison on its right basis, using the best incandescent gas-burner, the difference would be at least doubled. No wonder well-advised lighting authorities were adopting incandescent gas-lamps. Liverpool, one of the best lighted cities in the kingdom, had only 185 arc lamps, against 13,300 incandescent gas-lamps. Sheffield was almost entirely lighted by incandescent gas-lamps. Both of these cities owned the electricity undertakings, and bought the gas from private companies. Bradford had only 52 arcs; the remainder of the lighting being done by incandescent gas. In the whole of London there are under 5000 arc lamps used for street lighting; and while this system was at a standstill, incandescent gas was being rapidly extended. Even when high-power units were desired—as in the new thoroughfare between the Strand and Holborn—incandescent high-power gas-lamps had been recently installed, as being the best and most economical system of lighting. On the Continent the report was the same. In the beautifully lighted City of Berlin, there were only 576 arc lamps, against 23,215 incandescent gas-lamps; and in Paris 1719 arcs, against 49,294 incandescent gas-lamps. In Glasgow, incandescent gas was being rapidly installed; and though they were not yet reaping the full value of the change, owing to the difficulty of dealing with so large an area in so short a time, yet when the Lighting Inspector had got his men trained, and all his arrangements completed, Glasgow would take a high place as a well-lighted city. There was one other point he would like to note—viz., that Mr. Bradley's tests were only made on clear nights. Mr. Bradley well knew the value of this in favour of the electric arcs. He believed that in Westminster there was a stock of oil-lamps kept to place at important positions on the streets during times of fog. Other districts in London were placing high-power gas-lamps between the electric lamps at all their busy street crossings, as the arc lights were of practically no use in fog. There were many purposes for which electricity could be employed with much advantage (Mr. Wilson remarked, in conclusion); but in the existing condition of affairs, street lighting was not one of them. Without doubt, the most efficient and economical method of street lighting at present known was by incandescent gas-lamps.

* See "Journal," Vol. LXXXV., p. 684.

THE "HELIOS" DIE-STOCK.

There has recently been brought under notice what is undoubtedly an ingenious, and at the same time simple, device applied to die-stocks, by which a wide range of work can be accomplished with one stock. Its usefulness to gas-works and outdoor fitters must be acknowledged.

Fig. 1 represents the stock and dies in part section and outline; and it will be seen that there are four dies so arranged that their ends are in contact one with the other, and their sides each in contact with the frame of the stock. The movement of the dies is strikingly interesting, particularly to anyone of a mechanical turn of mind. The die numbered 1 has a keyway which engages with a sliding nut that is actuated by a screw passing through the stock. When the handle—which, by the way, is removable and also serves as a spanner—is turned, the leading or actuating die (No. 1) advances or recedes, and, in so doing, presses on the end of the adjacent die (No. 4 or No. 2), according to the direction in which the handle is turned. This transmits the pressure to No. 3 die the result being that a sliding motion, in either direction at will, is imparted to the whole of the dies, each sliding on the end of the other, and in and against the stock. It will be apparent to the reader that, to obtain this motion, both stock and dies must, of necessity, be of mathematical accuracy. By these means, the circle of the cutting edges of the dies can be increased or decreased as desired; and a wide range of diameters of tube or bar, limited only by the number of threads per inch required for the respective diameters, can be screwed with one set of dies. The top plate, shown as moved to one side in fig. 2, is fixed in position by the triangularly placed studs and nuts; and the dies are firmly held between this plate and the bottom one—it being impossible for them to move in any direction except in a horizontal plane.

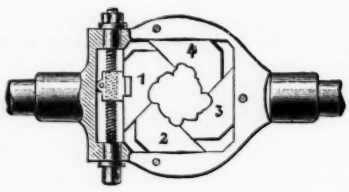


Fig. 1.

Fig. 2.

The stock carries an index, as shown in fig. 2, by means of which, in conjunction with the line on No. 1 die, the dies can be set, with a perfect degree of exactitude, to any diameter, including intermediate diameters—viz., full or bare of the standard; the latter being shown by the micrometer index on the collar of the actuating screw. The dies are made of specially hardened steel, and will cut a full depth thread with one cut only. They engage at once—that is to say, the piece to be screwed does not require to be chamfered or prepared in any way; the full depth thread being started immediately upon the rough end.

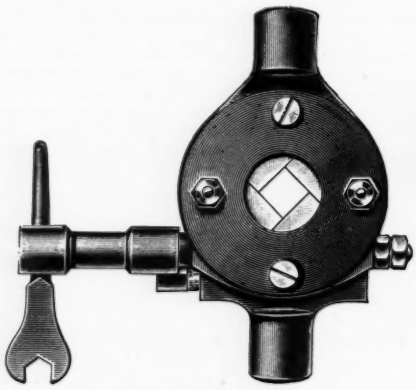


Fig. 3.

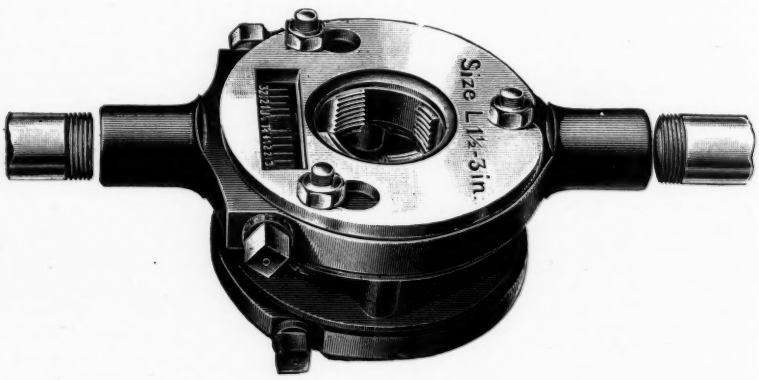


Fig. 4.

With the stock and dies is supplied the guide shown in fig. 3. This is actuated on precisely the same principle as the screwing-dies, and is connected to the stock by two removable bolts (as shown in fig. 4), and operated by the same handle as the stock. The guide is adjustable for the same range of diameters as the stock with which it is employed. The tube is placed through the guide; and the guide dies are screwed up to clamp it firmly, but not rigidly. The stock and guide being in the same horizontal plane, and the tube being at right angles to the guide, the thread cut by the stock and dies must be squarely cut on the tube. The guide is easily removed from the stock, and need only be used when required.

The stocks are made in various sizes, called F, G, J, K, L, M, N. With the first two sizes, there are three sets of dies to each; with the J size, there are three or two sets; with the next three sizes, two sets; and with the N one set. F size will screw any diameter from $\frac{1}{8}$ to $\frac{3}{4}$ inch; G, $\frac{1}{4}$ to 1 inch; J, $\frac{1}{4}$ to $1\frac{1}{2}$ inch; K, 1 to 2 inches; L, $1\frac{1}{2}$ to 3 inches; M, 2 to 4 inches; N, 3 to 4 inches. Therefore, to take an example, with the stocks J and L, any diameter from $\frac{1}{4}$ to 3 inches, both inclusive, can be screwed.

These die-stocks are furnished with dies for either gas or Whitworth threads or both, according to requirements. Of course, in the case of Whitworth threads, on account of the various pitches required for different diameters, a larger number of sets of dies are necessary than with gas threads.

The principle of Kaisers' "Helios" die-stocks is also applied to screwing-machine heads for tube makers, &c. These interesting die stocks were brought to notice by Mr. Sidney Stone M.I.Mech.E., of No. 75, Finsbury Pavement, E.C.

PRESERVATIVE COATINGS FOR IRON AND STEEL.

The value to every gas manager of a good preservative material or his ironwork is too well recognized to need emphasizing; and any information bearing upon the subject of paints should possess interest. It is, of course, of the first importance that the material should be of the right kind, as otherwise the trouble and expense of laying it on will have been in vain. That there is divided opinion in regard to the quality of paints is evident from the fact that, at the last meeting of the American Society for Testing Materials, it was mentioned that the members of the Committee to whom the subject of preservative coatings for iron and steel had been referred had not been able to agree upon a report. It was therefore decided to have the individual opinions of the members as to the best methods of testing these coatings printed as a pamphlet; and this was submitted to the meeting. One of the most interesting of the statements contained therein was by Dr. Charles B. Dudley, the Chemist of the Pennsylvania Railway; and from an abstract of it which recently appeared in the "Engineering Record" we take the following remarks.

Dr. Dudley attaches the highest value to the test of service, as this will prove better than anything else whether or not the protective coating is worth using. Experiment as one may with exposure tests, and continue them as long as one pleases, it still remains to put the material into actual use in order to ascertain if it will give satisfactory results. If a metal structure is coated with a protecting paint, and at the end of any specified time it is found that the

material is not corroded and is in satisfactory condition, it will be evident that the coating will be valuable; if not, the verdict will necessarily be against it. Experiments with protective coatings in actual service are, however, extremely difficult to make, and are subject to many vicissitudes. Moreover, they require a long time before a conclusion can be arrived at. If the structure is a permanent one, the results only apply to the location under which the test is made; if moveable, serious difficulties are introduced into the test.

In view of these difficulties, exposure tests on smaller samples have been proposed. For instance, it is suggested to cover a number of pieces of metal with the various protective coatings it is desired to test, and expose them for a certain definite period. According to Dr. Dudley, however, there are at least four objections to these tests. In the first place, the samples are usually small, and consequently do not quite afford the same opportunity of getting the proper amount of coating on them as if they were larger. Moreover, the coating is usually done under more favourable conditions than would exist in actual service. Secondly, during exposure tests there is always the uncertainty as to whether something will not happen to the test samples—such, for example, as the record being lost, or the samples being injured, or somebody not conversant with the conditions interfering with them. In the third place, exposure tests take a long time, and this long time is not infrequently accompanied with changes in the *personnel* of those having charge of the test, with a forgetfulness as to exactly what was done with the various samples, and sometimes unfortunately with loss of interest in the test. Probably, however, the most valid criticism of exposure tests on panels or small samples is that the conditions are not those of actual service. The samples are located at one place with a certain exposure, but not that which structures actually get. Furthermore, the small panels are not under strain, which is characteristic of almost every metal structure in actual service; and whatever deterioration may be due to strains does not appear in the exposure tests. These statements are not made to prove that exposure tests are not valuable, and do not give at least some indications which may be of service. But Dr. Dudley believes that, in order that exposure tests on panels may be really valuable, they should be much more elaborate, and more carefully watched, than any exposure tests he has ever known. In view of the difficulties connected with either service tests or exposure tests of protective coatings, it has occurred to Dr. Dudley to attack the problem in a different way—namely, to ask what the protective coating is required to exclude from the surface of the metal; and if this can be found, to test protective coatings as to their ability to exclude this objectionable material. This raises the question of the theory of corrosion or rusting of iron and steel; and while it may not be possible at present to say the last word on this subject, he cannot help feeling that if a protective coating keeps out water in every form, there will be no corrosion. It is on this thesis that what follows is based.

Starting with the statement that if water can be kept out there will be no corrosion, the first thing to be done is to inquire in what forms water may get at the surface. It is obvious that there are two sources from which water may come—first, from the rainfall or other exposure; and, secondly, from condensation of moisture from the atmosphere. The successful protective coating, if Dr. Dudley is right, must exclude from the metal water falling on the surface during rains, or water that condenses when the dew-point is reached. This leads to the question whether there is any test that will determine if water permeates paint or other materials designed to be used as protective coatings. Some time was occupied at the Altoona Laboratory in trying to devise a test of this kind. The first thought was to put on glass, or other transparent non-absorbent surface, some substance which would change colour when water found access to it; and after the gum holding the material had been dried out thoroughly, to coat it with paint or other protective coating, and then put the painted object into water. Experiments with anhydrous sulphate of copper and other materials which change colour when water gets to them did not prove very satisfactory. Apparently during the drying of paints of which linseed oil is a constituent water is formed in the layer itself, due to the chemical action.

The most successful results in the attempt to test whether water permeates a layer of paint or other protective coating were obtained by using a water solution of dextrine. Dextrine can be completely dissolved in water, so as to give a uniform smooth layer such as appears, for example, on the back of a postage stamp. This layer, when applied moderately thick, has a slight tendency to peel when drying. The addition of a little ordinary alcohol seems to overcome this tendency. A good working formula is 20 grammes of dextrine, 40 c.c. of water, and 30 c.c. of alcohol. In spreading, it is desirable to have the layer as thin as convenient, and to allow it to dry out without heat for 10 to 20 minutes. In heating, it is not desirable to exceed 150° Fahr. Such material applied to a portion of a piece of glass, for example, and then dried out thoroughly, using heat if necessary, gives a thin layer on the surface. If now the whole piece of glass is coated with a paint or protective coating, and it is allowed to dry, and followed by another or a third coat if desired, the whole being allowed to dry and harden for a certain period, the result is an object which, when plunged into water, gives apparently a very satisfactory test as to whether water gets through the layer. Dr. Dudley made a number of tests, and found to his astonishment that scarcely any paint containing linseed oil as a constituent is impervious to water.

The question may be asked: Why is it, or how does it happen, that a layer of paint made with linseed oil should allow water to get through it? It seems almost incredible that an oily substance spread out in a thin layer should not so completely repel water that there would be no permeation of the layer. But it must be remembered that dried linseed oil is no longer an oil. The mass of dried oil, if Mulder's researches may be trusted, is a tough, leathery sort of material, which does not leave an oily stain when touched, and which is changed chemically from being an oil into a material which he calls "linoxyn." During the drying, or the change of the oil to linoxyn, there seems little doubt that oxygen is absorbed and carbonic acid is given off. But if carbonic acid is given off as fast as it is formed, it must escape, not only from the outer surface of the paint, but also deeper down in the layer; and it is believed that this escape of carbonic acid leaves apertures in the dried layer, through which the water passes when the material is tested, as already described. Whatever the philosophic explanation of the porosity of the layer of dried linseed oil paint may be, if Dr. Dudley's experiments are to be trusted, this porosity is a universal characteristic at least of the layer two weeks old. It would, perhaps, be too strong a statement to make without limitation, but he cannot help feeling that his experiments seem to indicate that it will be difficult, not to say impossible, to make a perfectly water-resisting protective coating out of a material which consists largely of linseed oil. Substances brought forward as protective coatings which dry by evaporation of the solvent seem to offer much more prospect of success.

Our American contemporary considers it would hardly be fitting, in the present state of knowledge of the case, to discuss methods which have been suggested to make the layer of paint impervious to water—such, for example, as mixing with the paint an oil which does not undergo chemical change, but remains an oil in the paint layer; also dusting over the paint, just before it becomes completely dry, finely divided pigment, with the object of filling in all the little pores or interstices that may be left as the result of the operation of drying, or exposing the painted object to a temperature sufficiently high to soften the layer, so that the pores would close up, as is done in the well-known operation of enamelling. Dr. Dudley's thought in this whole matter was that if we had some test that was completely reliable to show whether any material suggested or offered as a protective coating actually did prevent water from reaching the metal layer underneath, it would be a decided step forward in the study of this interesting problem. It is not hoped or expected that the test suggested above will be final. At present it is the best he can suggest; and it is hoped that further study along this line may result in either improvements in it or the development of something better. Finally, it is not hoped or expected that a test which enables one to say that any given protective coating actually prevents water from reaching the material will justify the conclusion that such protective coating will be satisfactory in service. Of course, exposure tests to get the influence of the sun and to study durability under actual conditions are still essential. But it is believed that no protective coating will be a satisfactory one which does not keep out water, and that every successful coating must pass the test suggested, or some modification of it. If this reasoning is correct, subsequent investigations must begin at this point; and if Dr. Dudley's experiments are to be trusted, the protective coatings at present available are not so valuable as we had hoped. It must be remembered, however, that the suggested tests are not put forward as absolutely reliable.

It is estimated that the world's output of coal last year will probably not have reached 230 million tons.

The late Sir Richard Henry Wyatt, who died on the 5th of October last, as recorded in the "JOURNAL" at the time, left personal estate of the net value of £234,013; the entire estate being valued at £260,098.

Acetylene gas was not represented to advantage at the St. Louis Exhibition, according to the "Engineer," the exhibit being scattered; but there were several European and South American systems of generators. It is stated that there are 330 towns now lighted by different acetylene gas systems; 121 being in the United States, 80 in France, and 54 in Germany.

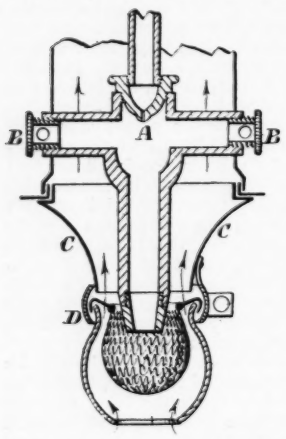
At the Institution of Civil Engineers, last Tuesday, Sir William White gave an interesting account of the visit paid by the members to the United States last year, during his term of office as President. Referring to the International Engineering Congress, which was opened at St. Louis on the 3rd of October, Sir William stated that the attendance (including ladies) was 876, and of this total 92 were citizens of the British Empire—73 coming from home and 19 from the Colonies and India. This large attendance of British subjects—50 per cent. greater than that of all other countries combined, apart from the United States—was, he said, highly appreciated by their American hosts. Throughout the meetings the greatest cordiality and good feeling prevailed; and, though most of the British members had to leave earlier, he himself, at the request of the President and Committee of the Congress, remained till the concluding meeting, which furnished the culminating expression of goodwill to the Institution of Civil Engineers from their American brethren.

REGISTER OF PATENTS.

Inverted Incandescent Gas-Lamps.—Liais, L., of Paris. No. 25,036; Nov. 18, 1904. Date claimed under International Convention, Dec. 12, 1903.

These improvements have reference to patent No. 16,244 of 1903, and relate to the application of such a burner to railway carriages, street-lamps, and the like.

The lamp comprises an inverted burner of metal which is a good heat conductor—a hollow cone acting as a conical lateral reflector, a chimney from or by which the burner and lamp are suspended, and a flat reflector. The burner is provided at its lower end with a nozzle of steatite; and within the upper part of the burner is formed a gas or vapour injector A surmounted by the gas-pipe. Disposed on each side of the burner are air admission tubes with screw plugs, which fit tightly to prevent them shaking loose through vibration. These hollow stop screws are provided with a lateral hole B to regulate the air admission. There is combined with the burner a conical, or approximately conical, reflector C, which has attached to it a divided metal collar D, which naturally springs to its most open position but can be kept closed by a thumb screw which passes through two lugs formed on the contiguous ends of the split collar. The object of this collar or band is to hold the glass globe, which in turn supports the mantle by any suitable carrier—such as a spoked or armed socket to which the mantle is attached, and which is combined with the glass globe so that when the globe and mantle are handled the mantle is kept free from injury.



The gas passing through the injector A mixes with the air admitted through the lateral holes of the hollow stop screws, and thence passes to the mantle, where it is burnt; the air necessary for combustion being admitted through the opening in the bottom of the globe. The products of combustion pass upwards inside the conical reflector through the chimney to the cap of the lamp, as shown by the arrows.

A general description of the lamp was given in the "JOURNAL" for Sept. 20 last, p. 814.

Photometric Apparatus.—Trewby, G. C., of Hampstead, N.W. No. 27,791; Dec. 18, 1903.

It has been proved by experiment (says the patentee) that the Gas Referees' table photometer, as at present prescribed for use in the Metropolis, does not permit of an accurate test of the illuminating power of gas unless the gas happens to be of such composition that, when evolving a light to produce equality on the photoped, the dimensions of the flame are those most suitable to the prescribed argand burner and chimney. As the details of this burner and chimney are strictly and uniformly adhered to, it is obvious that gas burnt in it at a short flame-rate will be over-oxygenated; while the reverse is the case should the flame be longer than the burner will properly take.

The inventor proposes to correct this tendency to inaccuracy by arranging the photometer so that the burner can be used at the proper point of its efficiency—that is to say, with the standard "London" argand burner, a flame of from 3 to 3¼ inches in length, and with respect to other standard burners, a height of flame which will "give the proper efficiency for such burner."

To effect this, he causes either the pillar carrying the argand burner or the standard lamp to be capable of movement nearer to, or further from, the photoped—at the will of the operator. Equality of light on the photoped may thus be attained instead of by the adjustment of the gas rate. The gas rate will be first adjusted to give a flame of a certain prescribed length within given limits; and the operator will then retire or advance the burner or lamp until equality of light is observed on the photoped. He will then read from a scale divided in accordance with the rule of inverse squares the actual illuminating power of the flame. After ascertaining the rate of gas consumption by the meter, and correcting for temperature and pressure, a rule-of-three sum will give the actual illuminating power for 5 cubic feet.

In the photometer for gas-testing purposes at present in use in London and elsewhere, the patentee further remarks, the method is adopted of fixing the position of the gas-burner consuming the gas under test and the position of the standard of light, and to secure the "balancing" or equality on the comparison screen by varying the quantity of gas passing to the burner. The illuminating power yielded by the gas under test is thus inversely proportional to the quantity required for equalling the effect of the standard light. As a burner "can only give its maximum result with a certain size of flame, and the burner used for photometrical purposes being closely defined by legal enactments, it follows that the method described can only provide accurate indications of quality under very exceptional and coincidental circumstances."

Fig. 1 is a plan of the table photometer now prescribed for use in the Metropolis and elsewhere, and the lettered portions are those introduced or modified by the patentee.

A is a carriage, carrying the burner; B, a rod from the carriage to a screw C working by a handle D. E is a scale (graduated in candle powers) which is indicated upon by a pointer affixed to the carriage; while F is a similar scale showing the movements of a pointer attached to the screw C. Fig. 2 is a side view of the carriage A carrying the burner on the pillar B mounted upon the scale C, with a gas connection of flexible tube D.

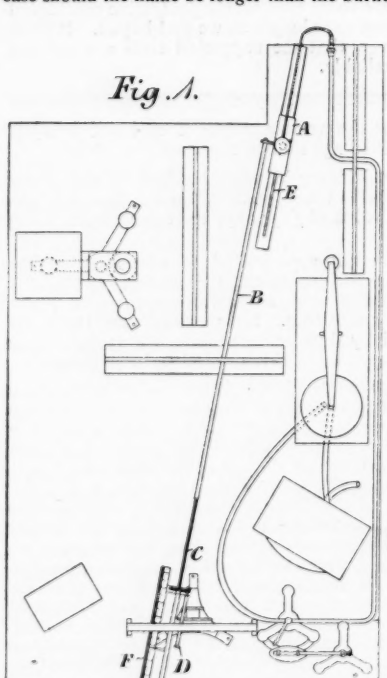
Fig. 3 shows (in sectional elevation) a means of obviating the flexible tube and obtaining the gas communication to all the positions of the burner by means of a mercury or other liquid trough. A is the liquid trough; B, the carriage; C, a gas-pillar carrying the burner and communicating with the chamber above the liquid surface; D, flanged rollers running on the edge of the trough and supporting the carriage; E, a gas-pipe; and F, the top of the wooden table into which the trough A is sunk.

Fig. 4 is the same arrangement as fig. 3, only in plan; A being the trough; B, the carriage; C, the burner pillar; and D, rollers running on the edge of the trough and supporting the carriage. G is a graduated scale.

The method of operating is as follows: The burner and the standard of light being lighted, the flame of the former is set by a regulating tap to a convenient height of flame. The handle D (fig. 1) is turned—thus actuating the screw C and drawing or repelling the rod B, which is attached to the carriage A. The relative distance of the two lights from the comparison screen is thus varied until equality of lighting-effect is produced. Actual candle powers may then be read off on the scales F.

In case it is required to move the standard light, which in the arrangement illustrated in figs. 1 and 5 is a pentane lamp, it will be obvious that the mechanical arrangement shown in fig. 1 for effecting the movement of the burner will also apply to the movement of the standard lamp—this latter requiring to be mounted on a travelling carriage and fitted with a graduated scale. Also it requires an arrangement for preventing the liquid used as a carburetting material (pentane in most cases) from being disturbed, and thus disturbing the steadiness of the flame of the lamp. The carburettor is therefore attached to a separate stand or pillar, and its connection to the lamp made by means of a flexible tube.

Fig. 5 shows such a pentane lamp with its carburettor on a separate pillar. A is the lamp; B, the carburettor; C, the stationary pillar carrying the carburettor; D, the flexible tube connection; E, the rollers of the carriage F; G, the edge of a wood-scale which acts also as a runner or guide for the rollers; and H, the screw to which the rod arm B (fig. 1) is attached.



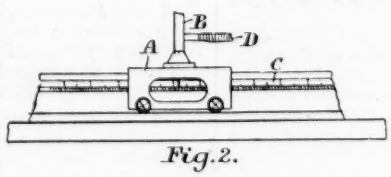


Fig. 2.

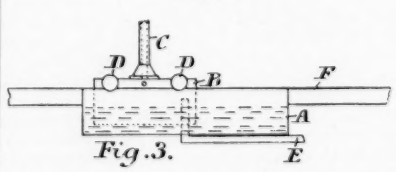


Fig. 3.

Fig. 4.

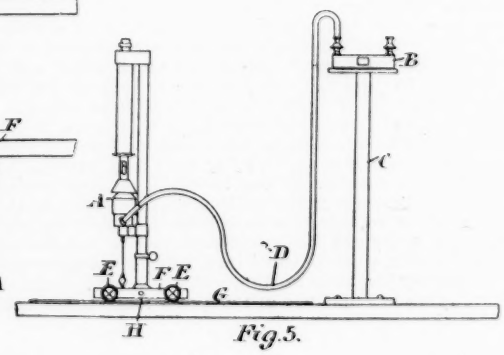
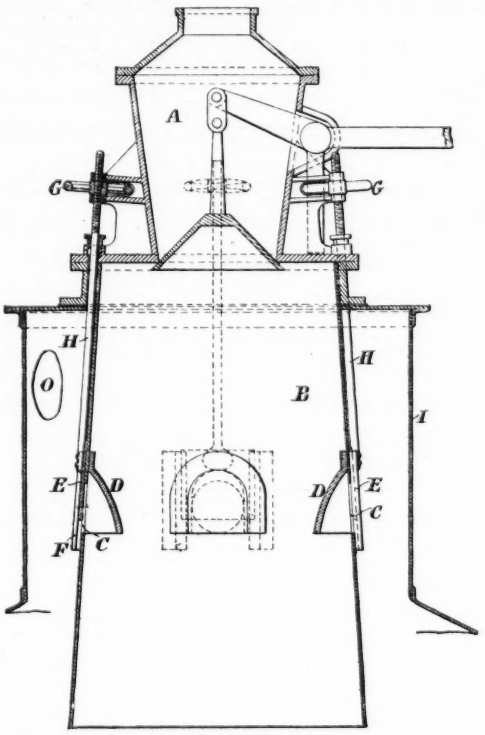


Fig. 5.

Gas-Producers.—Mond, L., of Regent's Park, N.W. No. 28,031; Dec. 21, 1903.

In patent No. 12,440 of 1893, a gas-producer is described, having in its upper part an iron cylinder or truncated cone, reaching some distance down into the producer. This bell is always kept partly filled with fuel, which, after undergoing partial distillation in the bell, passes continuously into the combustion zone of the producer below. The products of this distillation in the bell have hitherto been compelled to escape at the bottom of the bell and pass through the incandescent fuel underneath it, with the object of converting the tarry matters they contain into permanent gases. With certain fuels, it was, however, found that it is more advantageous to let these volatile products escape through openings in the bell, together with the gas generated in the producer, and thus recover as large a quantity of tar as possible as a bye-product. For this purpose, according to the present invention, the bell is provided with openings, slots, or holes affording passages for gases and vapours, controlled from outside the producer. When



the passages are open, a certain quantity of gas rises through the fuel contained in the bell, and escapes through them, carrying with it any tarry vapours evolved from the fuel contained in the bell. By adjusting the opening of the apertures, it is possible to let more or less gas pass that way—thus regulating to a great extent not only the quantity of tar produced, but also its quality. When the apertures are open to their full extent, a comparatively large quantity of gas goes through them, and the tar becomes much more fluid; while when they are closed the tar becomes stiffer, and approaches more nearly to the consistence of pitch.

The hopper A is of ordinary construction, and the bell B is similar to that described in the earlier patent, save that it has holes C in it, provided (within the bell) with hoods D, and (outside the bell) with covering slides E. The latter work in guides F, and are raised and lowered by hand-wheels G, the bosses of which are nuts working on the screwed ends of rods H fixed to the slides. The gases escape through the holes C, when the slides E are more or less raised, into the casing I, whence they pass through the main O to the usual purifiers.

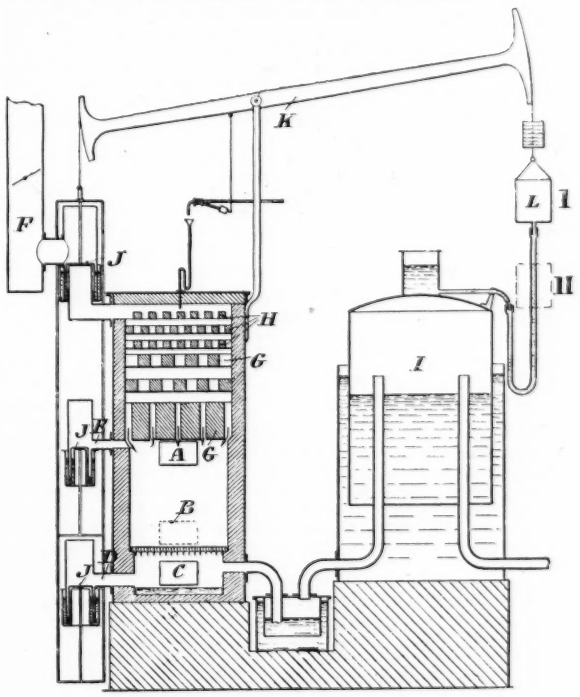
Manufacture of Water Gas.—Guénot, L., of Paris. No. 11,105; May 13, 1904. Date claimed under International Convention, May 14, 1903.

All generators of water gas in a retort or producer are (the patentee points out) actuated by alternate operations, which have heretofore always been effected by hand. Moreover, in the bulk of these generators, there is introduced into the retort air under pressure for re-heating the retort, and steam or water for producing the gas. It is obvious, he remarks, that such generators are very impracticable, as they all depend upon the attendant, "who is constantly occupied with opening and closing the admission of air and steam, and the outlet for the smoke." Besides, there are required bulky and expensive auxiliary apparatus for producing air under pressure and steam. His object is to avoid these disadvantages, by employing a generator which effects the alternate operations automatically.

The illustrations show a vertical sectional elevation of the complete apparatus, and a device for controlling the outlet of the smoke flue.

The retort is of fire-brick, and enclosed by a casing of sheet iron. The fire-grate is cooled by a tray containing water, as usual. Fuel of any kind is delivered to the grate through a door A. Two other doors B C serve for removing the clinker and ashes respectively. The air necessary for the combustion of the fuel enters through tubes D and E; the burnt gases escape into the flue F after having passed a first chequerwork G called the "superheater" and a second chequerwork H of wrought or cast iron called the "vaporizer." The water is supplied to the retort through a funnel-pipe bent to form a trap and fixed to the cover of the casing. The gas, on being generated, flows into a holder I through a water-seal. Each of the outlet tubes is provided with a water-seal and bell J. The three bells are connected by rods to a frame which is movably suspended from one end of a lever K, which bears at its other end a balance-weight and a small tank L, which communicates (by means of a flexible pipe) with another small tank placed above the bell of the holder. This second tank, when the bell is in its lower position, is filled with water. The water is supplied to the pipe above the generator by a pipe in which is interposed a valve M controlled by the lever K; and the draught of the flue F is controlled by a flap or damper actuated by a device controlled by the temperature, as hereafter described.

The operation of the apparatus is as follows: When the retort is well heated by the fuel, the lever K takes up the position shown; the bells of the water-seals dive into the water; and the valve M is opened. The water falls through the funnel-pipe over the iron bars of the vaporizer H, whereby steam is generated, which descends among the chequerwork G of the superheater down to the fuel, which it reaches at a very high temperature. The steam is, of course, decomposed by the fuel; the hydrogen remaining free, and the oxygen combining with the fuel to form carbon monoxide and carbon dioxide. The mixture of these gases traverses the fire grate and passes into the holder I. The bell of the holder rises rapidly with the small tank above filled with water; and when the bell has nearly attained its uppermost position, the level of the water in the tank is in a much higher horizontal position than the bottom of the tank L suspended from the lever K. In this position, the water passes from one tank into the other; and the bell continues its upward movement until the tank L has got sufficient weight to pull down the corresponding arm of the lever, which causes the opposite arm to raise the frame carrying the bells J. The lever does not stop turning until the bells are out of the water and abut against the top of their vessels. The tank L has then reached the position marked II., and the valve M is closed, so that the water supply to the retort is entirely stopped.

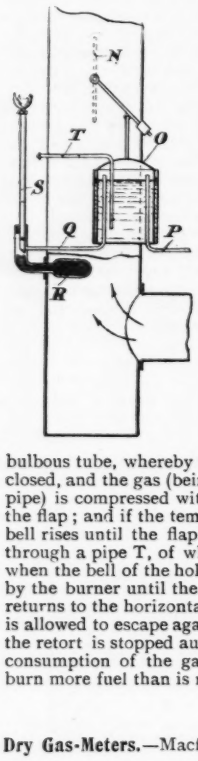


Air is now allowed to enter below the grate by passing freely through the tube D, and revives the combustion of the fuel. But, on account of the rather close disposition of the fuel, the gases of combustion contain, besides the carbon dioxide, a certain quantity of carbon monoxide; and for the purpose of transforming this into carbon dioxide, a corresponding quantity of air, which may be controlled at will, enters the space above the fuel by passing freely through the tube E. The superheater G is intensely heated by the gases of combustion, and radiates this heat to the vaporizer H; the gases escaping into the flue F in a nearly cold condition. During the whole re-heating period, of course, no water gas is produced, so that the gasholder bell falls according to the consumption. When the bell has nearly reached its lowest position, the bottom of the tank on the bell falls below the level of the water in the tank L in the position II.; so that the water flows into the former tank, which continues to descend with the bell until the equilibrium of the lever K is interrupted by the emptying of the tank L. Consequently, the lever returns to its initial position, whereby the tank L ascends to the position marked I.; the bells J of the water-seals descend with their frames and dive again into the water, and the valve M is opened again, so that by the admission of water the generation of water gas re-commences.

To facilitate the alternate operations, and to diminish the weight of the water in its passage to and fro from one tank to the other, the bells J of the water-seals are poised in the following manner: The sum of the areas of the two bells for the incoming air may be made equal to the area of the bell for the escaping smoke; and, obviously, the gas contained in the retort during the gas-generating period exerts a downward pressure on the two air-bells, and an upward pressure on the smoke-bell. Consequently, the force exerting downward pressure on the air-bells is equal and opposed to that exerting the upward pressure

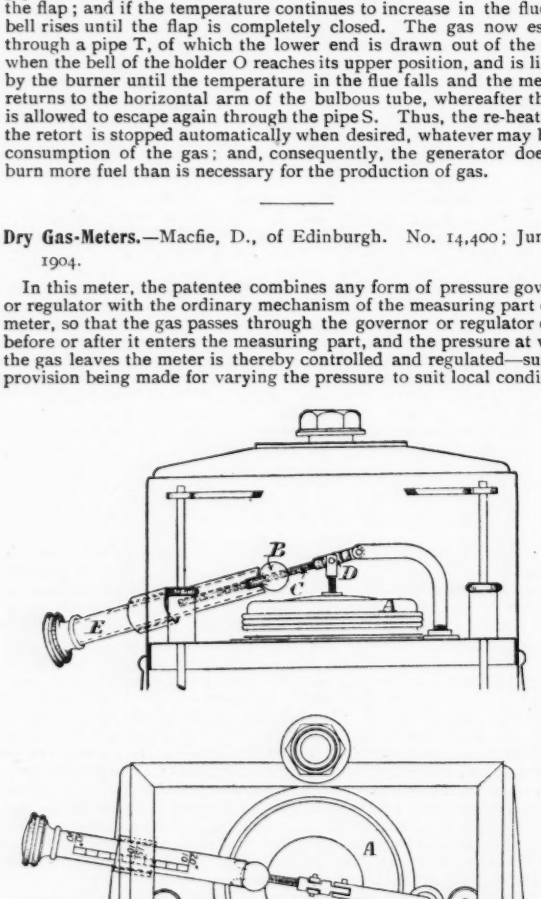
on the smoke-bell; so that one force compensates for the other—the bells being all fixed to one and the same frame. It results from this arrangement that the lever (being itself poised by the counterweight) can be caused to move by the passage to and fro of two or three pints of water from one tank to the other. The weight of the holder bell thereby varies very little, so that the pressure of the gas is practically constant. It results therefrom that a surplus of gas can never be produced, and that such a quantity only of gas is generated as is necessary to replace that being consumed. It is evident, however, that, with the dispositions as described above, the less the gas generated, the more the retort is re-heated, "which would not be rational nor economical."

To avoid this drawback, the flap or damper N in the flue F is controlled by the device represented. A very small gasholder O, adapted to receive about one-tenth of a cubic-foot of gas, is placed in proximity to the flue, and receives water gas through a pipe P of small bore. This gas is led from the holder through a pipe Q into a tube bent at right angles and formed with a bulb R. The horizontal arm of the bent tube and the bulb are filled with mercury and extend into the flue. A pipe S enters the tube with the bulb through a stopper. Its lower end, which is cut aslant, touches the mercury; while the upper end is provided with a small burner, which serves for testing the gas. The bores of these pipes are calculated in such a manner that, at the normal operation of the generator, the gas arriving in the small holder can be easily consumed by the burner. The bell of the holder O controls, by means of any convenient connection, the flap or damper N in such a manner as to open it fully when the bell is in its lower position, or close it completely when the bell is in its upper position. Normally, if the burner consumes all the gas arriving through the pipe P, the bell remains stationary, and the flap is fully opened; but when the temperature in the flue increases, the mercury expands and rises into the vertical arm of the bulbous tube, whereby the lower opening of the pipe S becomes partly closed, and the gas (being prevented from escaping freely through this pipe) is compressed within the bell, which, therefore, rises and closes the flap; and if the temperature continues to increase in the flue, the bell rises until the flap is completely closed. The gas now escapes through a pipe T, of which the lower end is drawn out of the water when the bell of the holder O reaches its upper position, and is lighted by the burner until the temperature in the flue falls and the mercury returns to the horizontal arm of the bulbous tube, whereafter the gas is allowed to escape again through the pipe S. Thus, the re-heating of the retort is stopped automatically when desired, whatever may be the consumption of the gas; and, consequently, the generator does not burn more fuel than is necessary for the production of gas.



Dry Gas-Meters.—Macfie, D., of Edinburgh. No. 14,400; June 25, 1904.

In this meter, the patentee combines any form of pressure governor or regulator with the ordinary mechanism of the measuring part of the meter, so that the gas passes through the governor or regulator either before or after it enters the measuring part, and the pressure at which the gas leaves the meter is thereby controlled and regulated—suitable provision being made for varying the pressure to suit local conditions.



The governor or regulator thus becomes a part of, and is contained within the case of, the meter—not affixed to it as a separate apparatus on the meter inlet or outlet.

The illustration shows one form of the meter; but any other form of governor or regulator can be used. A is a leather diaphragm to which the gas on the outlet side of the governor is brought, and which raises it. B is a weight acting through the lever C on the fulcrum D, and so pressing the diaphragm downwards. The greater the weight upon the diaphragm, the greater will be the outlet pressure thrown by the governor. By moving the weight nearer to, or further away from, the fulcrum, the weight upon the diaphragm is decreased or increased as required, so providing for a range of pressures. The weight may be made to move along the screwed lever by means of a key E inserted from the outside of the meter, and upon which key is marked the pressure at which the meter will be set according to the position of the weight.

APPLICATIONS FOR LETTERS PATENT.

16.—Southall, J., "Internal combustion engines." Jan. 2.
60.—Anyzewski, S., "Acetylene burners." Jan. 2.
92.—Gielis, H., "Furnaces with horizontal retorts." Jan. 2.
137.—Wegner, F. A., "Gaseous fuel burners." Jan. 3.
161.—Vogelsang, O., and Born, J., "Water-gas generators." Jan. 3.
191.—Quincey, S., and Harrison, C., "Flexible connections for gas-pendants." Jan. 4.
202.—Sturtevant, T. L. & T. J., "Carburettor for gas-engines." Jan. 4.
236.—Wilson, L., "Gas-turbines." Jan. 5.
244-5.—Rotherham, K, and Johnson, W., "Prepayment meters." Jan. 5.
263-4.—Economic Safety Gas Company, Ltd., and Fowler, C. C., "Carburettors." Jan. 5.
286.—Wright, G. E., "Air-valves for radiators." Jan. 6.
325.—Griffiths, R. A., "Gas-engines." Jan. 7.
342.—Crudgington, W., "Inverted incandescent gas-lights." Jan. 7.
353.—Wood, E, "Incandescent burners." Jan. 7.
366.—Maschinenfabrik and Mühlenbauanstalt G. Luther Akt.-Ges., "Gas-engines." Jan. 7.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Hydraulic Mains.

Sir,—It is interesting to me to notice Mr. Bell's letter in your last issue, particularly the last sentence—"I do not suggest that Mr. Beard's patent is a copy of my arrangement; it is another case of similarity of ideas." I saw Mr. Bell in the summer, and discussed my hydraulic main arrangement with him. He expressed himself as very pleased with it, and said he would like to come down and see it. The next thing I heard—not, however, by the courtesy of Mr. Bell—was that he had fixed up an arrangement of his own. There is no necessity to discuss the matter further in your columns, as Mr. Bell has very kindly promised to let me have a drawing of "his" arrangement, which will enable the case to be dealt with on its merits.

Nuneaton, Jan. 13, 1905. Geo. Helps.

Sir,—We notice in your issue of the 10th inst., a letter from Mr. George Helps.

When our representative called at Nuneaton on Oct. 20—now three months ago—Beard's patent anti-dip was discussed. Mr. Helps said he thought it was an infringement of his own; but our representative pointed out that this was not the case, and promised to forward full detail drawings so that Mr. Helps could examine them, and write us explaining the infringement, if any. We promised to give the matter immediate attention upon hearing from Mr. Helps. The drawings were sent on Oct. 22; but so far we have not heard from Mr. Helps, and are therefore surprised to see his letter in your columns.

We have decided opinions against discussing trade matter in the public Press, but shall be pleased to hear from Mr. Helps direct, and any communication from him will receive due attention.

Manchester, Jan. 14, 1905. R. & J. Dempster, Limited.

The Fatal Gas Suffocation Case in London.—At the inquiry into the circumstances attending the deaths of the aged couple named Hill, at Holloway, on the 5th inst., as reported last week (p. 111), the Coroner remarked on the danger of the old-fashioned water-slide chandeliers, one of which had caused the fatality, owing to the water in the tube having evaporated, and caused an escape of gas. He called attention to the fact that chandeliers were now made in which the use of water was unnecessary. A verdict of "Suffocation by coal-gas poisoning" was returned.

Abandonment of the Bury Corporation Bill.—The Bury Town Council having failed to confirm by the necessary majority the resolution passed last month to promote a Bill to enable them to construct additional tramways, and for other purposes, the proposal has, of course, fallen through. It will be remembered that one of the objects of the Bill was to authorize an extension of the limits of the gas supply, and the amendment or repeal of the Radcliffe and Pilkington Gas Act, 1854, in so far as it relates to the supply of gas by the Company within the borough, the township and parish of Ainsworth, and part of the urban district of Radcliffe.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Friday, Jan. 13.

(*Before the* MASTER OF THE ROLLS *and Lords Justices* MATHEW *and* COZENS-HARDY.)

Clark v. The Gaslight and Coke Company—Question of a Workman's Compensation.

This was an appeal by the defendants from a decision of his Honour Judge Smyly, increasing, upon a review, the amount of weekly compensation payable to an injured workman.

Mr. DANCKWERTS, K.C., and Mr. NEILSON appeared for the appellants; Mr. ARTHUR POWELL, K.C., and Mr. W. M. THOMPSON for the respondent.

The respondent was a coal porter, and on Dec. 16, 1899, in the course of his employment, he met with an accident whereby he lost parts of the fingers of his left hand. His wages were 41s. 9d. per week; and on the 16th of January following, the Company agreed that the amount of compensation to be paid under the Act should be £1. They afterwards offered him employment as gateman and timekeeper. This he at first refused to accept; but subsequently, on April 1, 1901, his Honour Judge French made an order reducing the compensation to 14s. 9d. per week, which with the respondent's wages as timekeeper made up the old rate of 41s. 9d. After this order he accepted the employment offered to him. He, however, persistently refused to note the times at which the men came to work, saying that it was spying on his fellow-workmen; and therefore he was dismissed on Nov. 22, 1902. He then brought an action against the Company for wrongful dismissal, but failed. In March, 1903, he applied to Judge Smyly to increase the amount of compensation from 14s. 9d. to £1; but his Honour refused to do it. The application was renewed in May, 1904, and it was successful.*

Mr. DANCKWERTS submitted that there was no such evidence of incapacity to earn wages as to justify the Judge in increasing the amount of compensation. When the sum was originally reduced, it was conclusively shown, by medical evidence and otherwise, as well as by the man's own admission, that he was fully capable of taking such a position as that of gate and time keeper; and since then there had been no change in the circumstances which existed when the application was first refused—the only fresh evidence given being to show that the man had made application in various quarters for a fresh situation as gatekeeper, and had been unable to obtain one owing to there being no vacancies. The County Court Judge had completely ignored the fact that Clark had a safe post where he was earning 27s. a week with the Company; and this position he had lost through his persistent refusal to obey the lawful orders of his employers—in fact, through his own wilful misconduct. He was therefore in the same position as a man who was capable of work and yet was voluntarily idle. There was no dispute as to the reason for his dismissal. It was as to whether the respondent ought to be called upon to perform what he was ordered to do; and his contention was that such a duty ought to be optional.

Lord Justice MATHEW: That was his case. He was wrong; and the decision was against him. He thought he was not called upon to do what his employers required him to do. But surely he should not be punished for all time for making a mistake.

Mr. DANCKWERTS said the fluctuations of the labour market had nothing whatever to do with this question, which depended entirely upon the man's physical ability to do work of any kind. It was clear that the Act did not intend to give a man a licence to abstain from work altogether because of an accident; nor was it intended to throw upon the employer all the risks of there being no employment of another sort obtainable by an injured workman. The County Court Judge had expressed the view that Clark's condition was exactly the same at the date of the re-hearing as it was when the amount of compensation was reduced.

Lord Justice MATHEW asked whether, when the amount was being settled in the first instance, the County Court Judge would be entitled to take into consideration the circumstance that the area of the man's employment was diminished, and that his opportunity of earning wages was therefore reduced and his income precarious, and to regulate the allowance to cover these contingencies.

Mr. DANCKWERTS replied that, since the first reduction, the area of employment had not been narrowed, but remained exactly the same.

Lord Justice MATHEW said he attributed the reduction in April, 1901, to the offer of employment by the Company.

Mr. DANCKWERTS contended that it was owing to the finding as to the man's physical condition; and this was arrived at having regard to the fact that in his employment he was to get 27s. a week. Was it to be open to a workman, on every occasion when he was out of employment, and was able to show that his being so was due to no fault of his own, but to there being no employment obtainable, to come forward and say that while this state of things existed the amount of compensation must be reviewed, and that he must be allowed the maximum amount? He should submit that it was not.

Mr. NEILSON also contended that the respondent was not entitled to increased compensation; it having been found by the Jury that his dismissal was due to his not having obeyed reasonable orders.

Without calling upon Mr. Powell, their Lordships proceeded to give judgment.

The MASTER OF THE ROLLS recapitulated the circumstances under which the appeal was made, and then said: The learned Judge has found certain findings which he lays before us as the basis of his decision. He finds that the condition of the man's hand is the same as when the award of the 1st of April, 1901, was made—that was the award which gave 14s. 9d. in addition to his wages as gatekeeper. The learned Judge further finds "that the applicant is now capable of earning wages as a gatekeeper, timekeeper, or watchman, or in any similar work where the full use of the hand is not required. I find that the above-named employment is a different one from that in which the applicant was engaged prior to the accident on the 16th of December; and I find that the applicant has recently made in good faith efforts to get such employment as that mentioned in my third and fourth findings, and has been unable to get it." Then he finds that, although the applicant may get odd jobs occasionally, they amount to a very small sum, and he has come to the conclusion that, though his physical condition is the same as it was at the time of the award, nevertheless, under the circumstances of the case, he has made out a claim to have further compensation given to him. Mr. Danckwerts has argued before us that this is a violation of the scheme of the Act of Parliament, and is also in conflict with a series of decisions in this Court. His point is that the only question to be considered in these matters is the special condition of the man, and that if it is once proved that this condition is such that he is capable of earning a certain sum in a certain employment, there is an end of the question, and that whether the state of the market admits of his getting the employment which if he got it he would be able to discharge satisfactorily, is not an element to be taken into consideration—that the mere fact of his physical capacity to perform the work if he could get it is enough to exclude the right to compensation on the footing that he could not get the work. Here we find, as a fact, that, although he could do work if he could get it, he cannot get it. We find that he has made *bonâ fide* efforts to get it, and that, in the learned Judge's opinion, he has, after fairly trying, failed to get it. It is said that under these circumstances he must nevertheless put up with that incapacity without any recourse to the employer to add to the compensation by reason of the fact that through the accident his area of possible employment has been narrowed, and that in the existing conditions of the market he is practically shut out. It seems to me that this contention is contrary to common sense, and it does not appear to be involved in any of the authorities that have been cited, much less in the actual words of the Act itself. What is the scheme of the Act? It is a scheme for compensation. Compensation for what? Inability to earn wages. That is at the bottom of the whole scheme. It is not merely, and does not pretend to be, compensation for the pain, grief, and physical suffering and physical injury. The man is looked at in relation to his wage-earning capacity, and you cannot exclude from the question at all the possibility of his getting the work. Unless the man gets the opportunity of putting forward his powers, such as they are, he is not in a position to earn wages. What they intend is to give him compensation not fully but partially—to give him something that is not an equivalent, but something they think will compensate him for his incapacity to work. Now, an accident arises, and the effect of it is to debar the man from earning his bread in the particular occupation which he has trained himself to carry out. He finds that he is shut out from that particular class of occupation. The Legislature does not say that this circumstance gives him the right to get compensation permanently to the full maximum which they assign in cases of injury. They make the standard the difference between what a man was able to earn in the original employment and what he is able to earn after the accident. You must take these two things into consideration. In both cases the wages which the man is in a position to earn come in as an essential factor in the discussion. No doubt this rests upon his physical capacity; but the effect of diminishing his physical capacity is to narrow the area of possible occupation. In this particular case, it so happens that after the man met with his injuries his employers were willing to make an employment for him, and that at once. He was physically fit to carry out the particular work that was demanded from him; and the wages they offered him were of such an amount as to make the compensation then determined by the learned County Court Judge adequate—viz., 14s. 9d. He was dismissed, and rightfully, because of his misconduct in that employment. How does that affect the question? It affects it in this way—that when the matter came up for discussion immediately after the dismissal, it was then open to the County Court Judge to hold, and he does appear to have held, that the reason why the man then was not earning his wages was, not that there was not a place for him, but that he would not keep the place that was open to him. Of course, he had to take that, and did take it, into consideration. Then after a long interval, matters are changed; and it seems to me that the learned Judge is quite justified in holding that he could not visit upon the man the consequences of his wrongful act in disobeying orders in that particular employment—that he could not visit him with the permanent consequences of that default on his part, which would take the shape of his being debarred for ever after from getting compensation, although he could not get employment. After all, when you look at the matter from a plain common-sense standpoint, this man has met with an accident in the course of his employment, and the Legislature has thought fit, in those circumstances, that the employer shall give him compensation. The ancillary provision that this compensation is to be reduced according as the man's capacity for work improves, is a provision in relief of the employer; he gets the benefit of it. But if a man has been injured to such an extent that he cannot command the opportunity, cannot command the right of earning wages, who is to suffer for that? Is that to be exclusively upon the master, who is by the scheme of the Act made responsible for the mischief that has happened to the man? Is it to be borne exclusively by the man, or is it to be borne by the master? It seems to me to be common-sense that if the learned County Court Judge comes to the conclusion that, through reasons for which the man cannot fairly be deemed to be responsible, he cannot get the opportunity of putting his diminished powers of earning wages into operation so as to earn the diminished amount, as that is his conclusion of fact, he is justified in saying that he cannot relieve the master by giving him credit for the wages which the man is debarred by his physical condition from earning. I agree with Mr. Danckwerts that, for many purposes, the fluctuations of the market are not to be taken into consideration. If a workman were in full health, and had not been injured at all, he would then have to stand

* See "JOURNAL," Vol. LXXXVI., pp. 454, 789.

the risk of the fall in his wages; and he equally has to stand that risk though he has been injured and has received some compensation. These matters of the fluctuation of the market are outside the question of compensation. I have nothing to retract from the observations I have already made in another case, to which my brother Mathew and I think my brother Cozens-Hardy were parties. We all desired to lay down what we thought the relation of the fluctuation of the market had to this question of liability. But I am not giving effect to these fluctuations in the market in any undue sense in upholding the decision of the County Court Judge in this case; because, in my opinion, it was perfectly competent to him to hold that, by reason of the physical condition of the man, the possible opportunities of this man of earning wages had been so narrowed that, in the circumstances of this case, it was not possible for him to earn, in relief of the employer's liability, such wages as he might have earned if he had had a wider area or greater possible choice given to him, and therefore had a chance that the County Court Judge could deem a reasonable one, of getting employment. The County Court Judge has come to the conclusion that, under existing circumstances, the man cannot get employment, and therefore he has refused to give the master the benefit of the hypothesis that the man could get it. That is the long and the short of the whole matter. It was a question of fact for the learned County Court Judge, it seems to me, and we have no right to interfere in any way with the decision.

Lord Justice MATHEW gave judgment to the same effect. After reciting the facts of the case, he said it was clear that the area of the man's employment had been most seriously diminished by reason of the accident that had occurred, and that he was incapable of finding such employment as he had had with the Gas Company. The County Court Judge, taking this into account, came to the conclusion—and the Court treated his decision with the greatest possible deference—that the man's old allowance of £1 a week was a fair thing to let him have. He had made that award, and the Court could see no reason whatever for upsetting it.

Lord Justice COZENS-HARDY said he was of the same opinion; and he only wished to make one remark. He could not assent to the view Mr. Danckwerts had presented to the Court, that the words in the Act of Parliament "able to work," are satisfied directly it can be proved that the man's physical condition is such that, if there were a possibility of work within a new limited area, he might be able to discharge it. If, for instance, a man lost one arm, medical evidence might satisfy a tribunal that he was perfectly able to discharge the duties of (say) a gatekeeper; but unless it could be shown that, in addition to his physical capacity to discharge the duties, there was a reasonable possibility of the man obtaining employment in such a limited area, he thought a County Court Judge would not be justified in saying that the employer was entitled to be relieved from the full amount of compensation, simply because of a finding which would have no real relation to the facts—viz., that the man might have earned money if there had been a possible opening for him in that calling. This was not as he read the Act, nor was it in any way consistent with any decision of the Court of Appeal in the cases to which the learned Counsel referred.

The appeal was therefore dismissed, with costs.

Saturday, Jan. 14.

Clasper v. Commercial Gas Company.

This was an appeal by the above-named Company against a decision of the Judge of the Bow County Court, awarding compensation to a young man employed in doing repairs to the roof of a retort-house.

Mr. LUSH, K.C., and Mr. COLAM appeared for the appellants; Mr. J. DUNCAN represented the respondent.

It was submitted that, on the evidence, the applicant was not in the service of the Company; that the accident occurred before he had commenced work or had earned any money; and that, therefore, it was impossible to apply the principle laid down in the Act for arriving at the average wage. The facts were as follows: The Company employed the father of the applicant to do some repairs to the roof of a retort-house—the arrangement at first being on a piecework basis; but, in consequence of some difficulty about measuring up, it was agreed that it should be paid for by time. Clasper, sen., employed his two sons to assist in the work; and while getting a ladder for the purpose of beginning operations, the young man fell and was injured. The learned County Court Judge's findings were—first, that the father (Thomas Clasper) was merely a person who engaged labourers for the Company, and that the applicant was in their employment; secondly, that he was injured on the premises of the employers when looking for a ladder; thirdly, that the man did, in fact, work for one hour, for which he was paid, in an employment which he might reasonably expect would last for a week or more; and that he was entitled to compensation. As the figures were not disputed, he awarded the amount claimed. This was about 16s. or 17s. a week, and was not material. The Judge's notes of the evidence were read; and it was contended that there was no evidence whatever to support the findings, and no liability on the appellants; the applicant being in the service and under the control of his father, who had contracted to do the work. It was further submitted that on the evidence, there was a contract by the father to do the work, and that he was the employer of the applicant. The evidence was that the father agreed to provide his own scaffolding; being paid for the work a larger sum per square foot than if the Company had found it. It was also argued that his responsibility towards the men he employed remained the same when, owing to difficulties in the measuring, a certain part of the work was done on a time-basis.

Mr. DUNCAN, for the respondent, contended that the finding of the learned Judge was correct; and he read portions of the evidence in support of his contention. He pointed out that the retort-house roof, which was paid for by square measure, had been finished for some time before the jobbing work at the purifying-house, in connection with which the accident occurred, was commenced.

The MASTER OF THE ROLLS said he regarded any decision of Judge Smyly with the greatest possible respect, and he had therefore followed the evidence very carefully, to see whether he could find any evidence which would justify the decision on the questions of fact, because he need not say that if there were any evidence fit to be considered by a Judge to form a conclusion upon, it was not the province of the Court to interfere. The question in this case was whether the injured man was really in the service of the defendants; and it seemed to him that the evidence was really all one way, and that the man was employed by his father and not by the Company. After reading several passages from the evidence, his Lordship concluded by saying there was no privity between the injured man and the Company, and therefore the appeal must be allowed.

Lords Justices MATHEW and COZENS-HARDY each gave a short judgment to the same effect.

The appeal was therefore allowed, with costs.

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Friday, Jan. 13.

(*Before the* LORD CHIEF JUSTICE *and Justices* KENNEDY *and* RIDLEY.)

Teignmouth Urban District Council v. Slocombe.

This was an appeal by the defendant that the findings and award of Mr. Edward Pollock, K.C., Official Referee, before whom the action was tried in July last,* and the judgment signed pursuant thereto in favour of the plaintiffs for £2000 and costs, might be set aside, on the ground that the Official Referee was wrong in holding that the contract bound the defendant to carry out in their integrity the requirements of the specification, except to the extent to which he was authorized to deviate therefrom by orders in writing, and that he was wrong in holding the defendant liable for breaches of contract in respect of deviations ordered verbally by the Engineer. The dispute arose out of an agreement made in February, 1898, whereby the defendant contracted to reline and roof the Hazeldown reservoir near Torquay; the plaintiffs alleging that the work was negligently performed. It was completed in October, 1898, and payment made in April, 1899; and there was no complaint of any kind till October, 1903. It was then suggested that the bricks and the quality and thickness of the concrete were not in accordance with the specification; and at the trial it was urged on behalf of the defendant that all the trouble had arisen by reason of a change in the scheme of repair after the contract was signed, and that all the work was done under the superintendence of the Engineer.

After considerable argument, the appeal was dismissed with costs; their Lordships considering that there was abundant evidence to support the finding of the Official Referee.

The Freightage of Gas Nuts.

A remitted case from the High Court came before his Honour Judge Lush Wilson, K.C., at the Exeter County Court on Wednesday last. The plaintiff was William Tyrell, master of the schooner *Richard Fisher*, of Fleetwood; and he claimed £18 10s. 2d. from Messrs. Rennick, Wilton, and Co., coal merchants, of Torquay. The claim was for freight and demurrage relating to a cargo of coals conveyed from Hull to Topsham in July, and was at the rate of 5s. 3d. a ton on 300 tons, with £1 1s. gratuity for the master and five days' demurrage at £2 10s.—making a total of £92 6s. The coals were for the Topsham Gas Company. A cash payment had been made to the master of £20, leaving £72 6s., for which the writ was issued. On Oct. 29, defendants paid into Court £53 15s. 10d., with a notice stating that this was sufficient to satisfy plaintiff's claim. The *Richard Fisher* carried a cargo of from 310 to 320 tons. On this occasion, the vessel was filled with what were known as "washed gas nuts"—coal that had undergone sundry processes, and was lighter than ordinary coal. When filled, the vessel was loaded with 277 tons 2 cwt.; but plaintiff refused to sign for this, and made out a bill of lading of his own. The vessel reached Topsham on July 23; but the cargo was not completely discharged until Aug. 5. Plaintiff, therefore, claimed five days' demurrage. Defendants said they would only pay freight on 277 tons; and plaintiff contended that, as he was engaged to load his vessel with coal, this meant coal in its natural state. He was, therefore, entitled to fill up with coal which would weigh out at the tonnage of the vessel. Plaintiff said that when filled with washed nuts, instead of carrying 300 tons, the vessel was only laden with 277 tons. He had never known ordinary coal to come out 7 per cent. less than the tonnage. Joseph Furlong, master of the *Taragona*, said that on the occasions on which he had carried nut coal it was specially set out in the charter. Evidence was given for the defence by men engaged in the trade, who stated that washed nuts were coal, and no specific mention of the kind of coal was made in the charter. His Honour agreed with defendants' point of view, and gave judgment for them, with costs.

Fraudulent Use of Gas.

At Dewsbury, a few days ago, James Crossley, a labourer, of Springfield, was summoned at the instance of the Gas Committee of the Dewsbury Corporation for disconnecting gas-pipes and fraudulently using gas. A collector in the service of the Committee stated that he visited defendant's house on the 3rd of December, and collected 1s. 1d. from a penny-in-the-slot meter. On a subsequent date he discovered that the pipes had been tampered with; having been cut and then rejoined in such a way that the gas did not pass through the meter. Defendant, who was spoken to later on as to the matter, professed knowing nothing about it. He said he left a friend alone in the house on one occasion, and he might have disconnected the pipes. The Chairman said they could not tolerate such liberties being taken with the property of the Corporation. A fine of 10s. and costs would be imposed.

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* See "JOURNAL," Vol. LXXXVII., p. 339.

MISCELLANEOUS NEWS.

FATALITY AT THE BATLEY CORPORATION GAS-WORKS.

Manager and Workman Suffocated.

A shocking fatality occurred at the gas-works of the Batley Corporation on Friday afternoon, the Engineer-Manager (Mr. J. F. Bromley) and a workman named George Sandall being found dead in a shed which had been formerly used as a coal-store, having apparently been suffocated by gas. At the time the following particulars were dispatched by our local correspondent, it was impossible to say exactly what had taken place. The works are in Soothill, and about a mile from the centre of the town. There had been several inquiries for Mr. Bromley during Friday afternoon; but as he could not be found, it was presumed that he had left the works to go into the town. Some of the workmen saw him about two o'clock; but no one appears to have seen him alive afterwards. No anxiety was felt at his absence, as he was often in the habit of leaving the works to visit the town. Shortly before five o'clock, however, someone wished to speak to him through the telephone on urgent business; and as he had not then returned to the office, a search was made. Eventually he and Sandall were discovered by the foreman at the gas-works, who immediately summoned assistance, and the unfortunate men were carried to the meter inspector's office. A doctor was also sent for; but on his arrival he pronounced life to be extinct. He also ventured the opinion that both Mr. Bromley and Sandall had been dead some hours.

The shed in which the bodies were found is joined at the dead-end to a building in which the sulphate of ammonia plant is located. Valves connected with the purifiers forming part of this plant are let into the wall, and are operated from the shed. It is presumed that Mr. Bromley had taken Sandall with him to make some repairs to the valves, or to change the purifiers. The valves are usually attended to under the supervision of a responsible official. It is supposed that the two men were engaged at the valves when they were overcome by a sudden escape of gas. From the expression on Sandall's face, there can be no room for doubt that suffocation was the cause of death. In gasping for breath, his jaws had locked, and gas oozed from his mouth and nostrils for a long time after he had been removed to the office. Both bodies, in fact, were so impregnated with gas that the windows in the office had to be broken to allow the fumes to escape.

Our correspondent adds: Mr. Bromley was regarded as a most capable gas engineer; and from the time he first came to Batley he had shown conspicuous ability, and his efforts had been attended with success. Improvements of an important character had been introduced at the works; and though the electric light was some time ago adopted by the Corporation, there was no reduction in the consumption of gas. By his capable management of the works, Mr. Bromley had won the approval of every member of the Corporation. For many years the works have proved a source of profit; and £2000 has been taken out of the profits for the relief of the rates, and a substantial sum has been added to the gas contingency fund. Sandall, who was 29 years of age, lived at Dewsbury. He had only been at the works about three or four months, and was employed as an assistant to the blacksmith, who was away ill on Friday, or the probability is that Mr. Bromley would have requisitioned his services for whatever was required to be done in the shed. Sandall was a married man, but had no family. The Gas Committee of the Corporation met on Saturday morning, and instructed Mr. Arthur Bromley, son and assistant of the deceased Manager, and Mr. Arthur Pickersgill, the foreman, to take charge of the works, until a permanent appointment is decided upon.

The inquest was opened yesterday, but only evidence of identification was taken, and the enquiry adjourned till Thursday.

OMAGH GAS-WORKS PURCHASE.

The Council Refused Possession.

A curious state of affairs with respect to the purchase by the Omagh Urban Council of the undertaking of the Gas Company was revealed at an adjourned meeting of the latter body last Wednesday, when the Gas Committee reported that, in reply to an inquiry from the Solicitor (Mr. F. Shields), the Local Government Board had stated that the Council would not be legally justified in agreeing to an account being opened for the gas-works by the Directors (pending payment of the purchase money), and cheques being payable thereout signed by them. Mr. Shields thereupon formally demanded possession of the works; but the Directors refused to give them up pending further directions from Counsel. The present position therefore is that the works remain in the hands of the Directors, in spite of the facts that they have already been advised that they cannot legally continue to hold them, and that the Council's Solicitor has asked for possession.

In the course of a lengthy explanation of the circumstances under which the deadlock had arisen, Mr. Shields said that at the last meeting of the Council a report of the Gas Committee was adopted, to the effect that, until the Council were in a position to pay, the gas undertaking should be carried on by a Joint Committee consisting of three members of the Council and three of the Directors. An account was to be opened in the bank in connection with the works, and all moneys received were to be paid into this account, and all moneys paid out were to be paid on the recommendation signed by two members of the Council and two of the Directors, and countersigned by the Manager. When the report was adopted, the Gas Committee summoned another meeting, and asked them to agree to terms somewhat different. The Directors then wanted the account to be in their name alone, and would make disbursements by cheques signed by themselves. The representatives of the Council did not agree to this proposal, because the Local Government Board would not sanction any scheme which would place the accounts belonging to the Council in the hands of outsiders—and the Directors were outsiders as far as the accounts of the Council were concerned. He put the matter before the Local Government Board, and they replied by pointing out that, under the Act, the undertaking should be vested in the Council as from the 1st inst. Moreover, they said, the rights of the Company were adequately safeguarded by sections under which the Council were bound to pay interest on the purchase and other moneys payable to the Company from the date of transfer till the date of actual payment.

The Chairman (Mr. Joseph Anderson, J.P.) having remarked that he could not make out what it was the Company wanted, the report was adopted. It will be interesting to see what is the next step taken by the Council.

HESSLE AND ITS PARLIAMENTARY BILL.

The Gas-Works Purchase Clause.

A good deal of opposition has been aroused by the proposal of the Hessle Urban District Council to promote a Bill involving several extensive schemes—one being the purchase of the Gas Company's undertaking.

At a meeting convened by the Ratepayers' Association, Lieutenant-Colonel Wellsted (who remarked that he was not in a position to occupy the chair because he was the professional adviser of the Gas Company) asked the Council to pause before they put the parish to such terrible expense as would be incurred; while Mr. Pearson, who presided, said that if the Council had promoted a Bill to buy the gas-works only, he did not think there would have been serious objection to it, though as the Company were applying to Parliament for statutory powers the Council could no doubt have obtained everything they wanted at scarcely any cost. Mr. Bailey moved—"That they consider the Bill unnecessary, uncalled for, and a great waste of taxpayers' money; and inasmuch as the Council could, in reference to taking over the gas-works, adopt the clause which the Company offered to include in their Bill, the Council are hereby requested to forthwith withdraw their Bill, and so stop the useless expense that is now being incurred." Mr. Stephen seconded, and said such a measure, to a place like Hessle, where the rateable value was only about £36,000, was likely to run up the rates from 2s. to 4s. in the pound. Mr. Stowe was of opinion that the Council had made a great mistake in not accepting the offer of the Company to have a clause inserted in their Bill giving the Council power to purchase the works on arbitration terms; while another gentleman cited cases in which, after having been purchased by local authorities, gas undertakings had proved a burden on the rates. In reply to this, Mr. T. Appleton (the Chairman of the Council) said he could cite numbers of instances in which the undertakings so bought had not only been paid for out of revenue, but had also given a surplus towards a reduction of the rates. Someone present queried: What about Brigg? Mr. Appleton replied: Oh, it stands alone, and is the exception to the rule. After further remarks, the resolution was put to the meeting and declared carried.

This gathering was followed last Tuesday by the statutory meeting of ratepayers, which was largely attended. Mr. Appleton, who presided, remarked in opening that the Local Government Board had furnished statistics which contained nearly a hundred cases in which authorities had purchased gas undertakings; and where they had had to call upon the rates it had only been for an infinitesimal amount, while the price of gas had been reduced. The Council were satisfied they would have nothing to fear. Hessle was a different place to Brigg, where the gas undertaking was stated to have been a failure. Hessle was improving; and the rates were now lower than they had ever been. Consequently, the demand for gas would increase. The Council considered, too, that the present was the time to purchase. The Company, by promoting a Bill for statutory powers, had forced their hands; and to oppose this Bill they were advised would cost them nearly as much as to promote one themselves. He could not say it for a fact, but he had come to the conclusion that if the ratepayers approved of the Bill, and backed the Council up, they would not have the Company's opposition. Mr. Thrale: You will have the very strongest opposition from the Company, especially on the clause as it is drawn up. Mr. Appleton (continuing) said the Company knew perfectly well that Parliament approved of the principle of authorities taking over gas-works. However, both Bills would be referred to the same Committee, and this was all the opposition there could possibly be. He mentioned that the estimate of Mr. F. J. Bancroft (the Council's expert) of the award for the purchase of the gas-works was £23,000. Mr. Macnamara made an effort to show that, according to the figures given, £1500 would have to be raised, either out of the rates or by the price of gas, to meet the yearly payments of principal and interest; but finally the resolution approving of this portion of the Bill was carried by a majority of practically two to one. It is reported that the opposition intend to demand a poll of the ratepayers.

Wrexham Gas Company's Bill.—At an extraordinary meeting last Friday, the shareholders of the Wrexham Gas Company unanimously approved of the Bill which is being promoted to enable the Company to raise further capital, and for other purposes. The Chairman (Mr. J. O. Bury) explained that during the past ten years the make of gas had practically doubled; being 121 million cubic feet last year as compared with 64 millions in 1894. A considerable part of the new capital required is for the erection of a large gasholder and additional condensing and carbonizing apparatus. In reply to a question, the Chairman said the Directors were pretty evenly divided on the question of reducing the illuminating power of the gas; but rather than create opposition they had come to the conclusion that it would not be desirable to ask for powers in this direction. The fact that flat-flame burners are still largely in use had, said another gentleman, also influenced them in coming to this decision.

SULPHATE OF AMMONIA MARKET.

Messrs. Bradbury and Hirsch's Review for the Past Year.

We have received from Messrs. Bradbury and Hirsch, of Liverpool, a copy of their "Review of the Market for Sulphate of Ammonia during 1904;" and, as on previous occasions, we extract from it those portions which most closely concern our readers.

Messrs. Bradbury and Hirsch open their "Review" by pointing out that, owing to the war in the Far East, the year was one full of political anxiety among the nations of Europe. They think there is no doubt that this reflected prejudicially upon trade and commerce; for although there was some recovery from the depression of the preceding year, there was all along a feeling of uncertainty as to the course of political events, occasioning more or less hesitancy in business enterprise. Happily the efforts to confine the region of hostilities to the Far East have been successful so far; and on all hands it is earnestly hoped that in the near future some basis of agreement may be found by the belligerents whereby peace may be restored. They go on to say that they do not propose to discuss local trades and local conditions, because the sulphate of ammonia and nitrate of soda trades are world trades; and they feel that they can only be profitably viewed from a much wider standpoint than can be afforded by purely local circumstances and conditions. They, however, offer a few comments upon the larger situation; the interdependence of trades being, they consider, a sufficient excuse for doing so.

Having called attention to the natural phenomena presented, since the preparation of their "Review" for 1904, by the cotton, wheat, and sugar trades, Messrs. Bradbury and Hirsch turn to the subject of nitrate of soda. Before proceeding to sketch the course of the market and to comment upon the more striking events of the past year, they refer briefly to the situation at the end of 1903. They calculated that the actual supply for January-April, 1904, would not exceed 710,000 tons, or 25,000 tons less than that for January-April, 1903. Consequently, so far as prospective supply was concerned, the position could hardly have been stronger. Prospective consumption also seemed to be fairly well assured, notwithstanding that the price was 6d. per cwt. higher than it was at the end of 1902, although the stock of sugar (both beet and cane) had increased substantially within the year. They point out that they were careful to indicate that the largely increased output of cane sugar in 1903 and the prospective increased output in 1904, not only from British and Dutch Colonies, but more particularly from Cuba and Brazil, were factors which must be taken into account seriously. But, on the other hand, the rapid growth in the consumption of sugar in beet-growing countries, consequent upon the abolition of bounties and the reduction of prices on the home markets, added to the world's steadily increasing requirements, seemed to them likely to absorb the supply without breaking the market. They therefore judged that the beet grower would not be deterred from sowing on at least as large a scale as in 1903, and that consequently the smaller prospective supply of nitrate of soda would be required, probably at some advance in prices. It appeared to them that even if there should be some shrinkage in the spring consumption, the market would not be endangered. The actual supply for January-April was 702,000 tons, or 8000 tons less than their estimate. The deficiency was almost wiped out, however, by the exceptionally heavy deliveries in April; the stock at the end of that month being reduced to 52,000 tons. By the end of May the deliveries showed an increase of 10,000 tons upon those for January-May, 1903; while the stock in Europe carried forward into June was only 32,000 tons. The actual deliveries, in tons, from the ports (United Kingdom and the Continent) were—

	1904.		1903.		1902.
January-March . .	456,000	..	500,000	..	385,000
,, April . . .	640,000	..	650,000	..	545,000
,, June . . .	828,000	..	825,000	..	735,000

There were no violent fluctuations in values during the first half of the year; for although there was a steady advance up to March, in view of an expected shortage in supplies, the shrinkage in deliveries from the ports, which commenced in February and which was continued in March, served to moderate the tone and in some cases to shake the nerves of holders. So that from March onward prices were barely maintained up to the end of May, while in June there was a decline of about 3d. per cwt. Spot prices throughout the year were highly satisfactory, due in the first half to short supplies, and in the second half more to the strong forward position than to actual demand.

The visible supply (stock and afloat) for the United Kingdom and the Continent at the end of last year was about 660,000 tons, compared with 640,000 tons in 1903, and 640,000 tons in 1002. The visible supply is thus 20,000 tons more than it was at the end of 1903; but it remains at the moderate total of 660,000 tons, notwithstanding that deliveries from the ports during November and December declined somewhat. Given a visible supply of 660,000 tons at the present time, Messrs. Bradbury and Hirsch ask: Can the actual supply for the next four months be estimated approximately? They essay the task, though strikes at shipping ports to interfere with shipments and contrary winds to delay arrivals are contingencies always liable to upset the most careful calculations. Last year they added 70 000 tons to the visible supply. This year, notwithstanding advanced freights and free-on-board prices, they think every effort will be made to ship the largest possible quantity by steamers in time for the spring demand, in order to take advantage of the high level of spring prices, and the future action of the Nitrate of Soda Committee being uncertain and rather feared. It is recognized that prices current have been quite above the level originally contemplated by the Combination; and there is, moreover, always a strong agitation for increased quotas. Therefore they do not think it safe to add less than 100,000 tons to the visible supply. This will give an actual supply for January-April, 1905, of 760,000 tons, or 58,000 tons more than the actual supply for January-April last year. They think it well to observe, however, that the shipments to the end of December were 135,000 tons in arrear of the quantity permitted to be shipped between April and December; so that it will be necessary to utilize very largely steamers in January and February if the actual supply for Europe from January to April is to be brought up to the quantity they have indicated as possible. Passing on to consider the more difficult question of the probable requirements, they say that although they estimate that the actual supply of nitrate of soda for January-April will be 58,000 tons more than for January-April, 1904, and though the present price is 6d. to 9d. per cwt. higher than the prices ruling last spring, they are of opinion that the supply will not be too much. At the same time, they say it must always be remembered that the cost of an article has a very important bearing upon the demand; and if the trade would content itself with 10s. 6d., or 10s. 9d. as a maximum, per cwt., they are confident that the whole supply would readily be absorbed. But if it is attempted to force the price above 11s., holders may find themselves at the end of the season with a broken market, and left with stocks upon their hands, as there would certainly be rigid economy in every direction.

Messrs. Bradbury and Hirsch now come to the subject of sulphate of ammonia. When discussing the situation at the end of 1903, they referred to the indifference of Continental buyers in the closing months of the year; pointing out that this attitude was due to their being able to obtain domestic production, prompt and forward, on more favourable terms, owing to the increased domestic output—more particularly German. Extensive purchases of the home product were, in fact, made at that time. They further pointed out that sulphate of ammonia had in December become relatively dearer than nitrate of soda; that this was nowhere more readily appreciated than on the Continent; and that consequently it would depend upon the course of the nitrate market whether the higher level of prices for sulphate which at the time seemed probable could be sustained over the spring months. Though Spanish, Japanese, and Colonial demand was good, and although with this and speculative buying they thought that prices would advance further, they had grave doubts about the stability of the United Kingdom market if the Continent remained uninterested. Their foreboding was amply justified, and by the reasons which were present to their mind. The advance of 7s. 6d. per ton in January upon a like amount per ton in the previous month left sulphate stranded high and dry so far as the Continent was concerned; nitrate having improved only 5s. per ton within the same period. No sooner had the year opened than shipments began to fall off; the shrinkage at the end of February to Germany and Belgium (the latter mostly in transit to Germany) being nearly 5000 tons, or 45 per cent. There was a relapse in price of 5s. per ton in February, and then the closing February price was maintained until the middle of April. This latter, however, was only rendered possible by accumulating stocks in the hands of makers; Continental requirements continuing to diminish.

This remark is well illustrated by the four tables of exports which are given at this point in the report. The first shows that up to the end of March there was no increase in exports; the shortage to the Continent being barely balanced by increases in other directions. The second table (covering the January-April period) demonstrates the extraordinary elasticity of Spanish demand, and at the same time the effect of lower prices upon Continental demand; the exports to Germany and Belgium having increased 1800 tons within the month of April. In the third table (January-June), the shipments to the Continent are seen to have increased a further 2000 tons during May and June: nitrate of soda being then relatively the dearer article. Those to Spain had, however, in the meantime decreased 2500 tons, owing to the action of speculators, who in May were offering July-August and July-September at a discount on spot prices, and thus encouraging buyers either to defer purchasing or to purchase for shipment in the months offered. That speculative action had this effect is demonstrated by the fact that the falling off in shipments to Spain in May and June was made up in July, August, and September. The fourth table gives the figures for the year. They were as follows: To France, Germany, and Belgium, 41,692 tons; to Spain, Italy, and the Canaries, 60,176 tons; to Holland, Java, British Guinea, West Indies, and Mauritius, 42 931 tons; to the United States, 9444 tons; to other countries, 23,044 tons (Japan taking 14,981 tons, against 3612 tons in 1903)—making a total of 177,287 tons, against 162,217 tons in 1903, 162,754 tons in 1902, 150,203 tons in 1901, and 145,285 tons in 1900.

Commenting upon the course of the market during the year, Messrs. Bradbury and Hirsch remark that, having sold the bulk of their output up to the end of March in advance, the large makers were in no hurry to make further sales for the later spring and summer months at a drop in prices, as they all along cherished the idea that with more favourable weather the market was bound to revive. But when in April they found that deliveries on contracts were being delayed as far as possible, that stocks had accumulated in the country, and that the nitrate of soda interest was more or less shaky, they abandoned the firm attitude so long adhered to, and offered their output freely. Between the middle of April and the end of May, there was consequently a drop of 15s. per ton; and although there was some recovery in June, the May price was again reached by the middle of July. But if makers paid the invariable penalty of accumulating stocks in February and March, speculators also overran the mark in May. If makers miscalculated the Continental demand in the early spring, speculators as little understood the possibilities of other demands later, or they would not have made large forward sales which it was never possible to cover without loss. The inquiry for home consumption was slow throughout, and there was a substantial shrinkage in deliveries in this direction. The most remarkable feature in the second half of the year was the persistent selling abroad on the part of speculators in July, August, and September for delivery July-October, August-December, October-December, December-February, January-March, and in some cases right up to June in the present year. The authors remark that the selling was no doubt made partly against purchases effected in June; but it is certain that it went much beyond that, and that a large portion of it was uncovered at the time. In November, up to £13 2s. 6d. per ton was paid f.o.b. at different ports for January-June delivery, and up to £12 10s. per ton for July-December f.o.b. Leith; and at the end of that month a substantial advance was demanded in all positions. This purchasing was for the most part speculative, and was no doubt mainly inspired by the very strong nitrate of soda market then ruling. With the advent of December, nitrate becoming easier, the tone of the sulphate market changed for the worse; consumers abroad refusing to buy

ahead at the advance, and speculators being unwilling to load themselves further. The spot market, which in November advanced 15s. per ton, was weak all through December—the demand from first to last being barely enough to absorb current production; and the closing price, f.o.b. Hull, was £12 12s. 6d. per ton. On the whole, the year's business did not come up to expectations, owing, as has been seen, to unsatisfactory Continental demand over the spring months. A setback of 5s. 6d. per ton in the average price for the year, compared with that for 1903, must be considered disappointing, and still more so when it is compared with the average price of nitrate of soda, which shows an improvement of 13s. 4d. per ton. The 1904, the average price of sulphate (£12 3s. 8d. per ton), compared with that of nitrate (£10 4s. 2d. per ton), shows up very badly alongside of £12 9s. 2d. and £9 10s. 10d. in 1903, and £11 16s. 3d. and £9 6s. 8d. in 1902. Messrs. Bradbury and Hirsch think makers would have done better if in the early spring months they had faced the situation, and offered their output as it became available, instead of stocking.

The estimate made by Messrs. Bradbury and Hirsch of the output of sulphate of ammonia from all sources in 1903 was within 400 tons of the actual figures; for though they were 2000 tons too high for gas-works, this was balanced by an under-estimate of about the same quantity from iron and carbonizing works. They point out that it is becoming increasingly difficult to estimate the output from gas-works, owing to the extension of the employment of water gas and electricity, which must always be set off against the extended use of gas for cooking and power, as well as for illuminating purposes. For 1903, there was no increase in the output of sulphate of ammonia from gas-works; but within the past twelve months, and more particularly within the past four months, there has been a substantial increase, due mainly to improved trade in the manufacturing districts. This has, however, been very unevenly spread; reports received by the authors from the Midlands showing an actual decrease in some cases, and in no case any important rise. There was no appreciable increase from iron furnaces; but that from shale amounts to quite 2000 tons—the improved plant adopted by some of the oil companies enabling them to turn out larger quantities. This came into operation in 1903; but the effect of it was in the main neutralized by the winding up of three companies working in 1902. Messrs. Bradbury and Hirsch remark that the adoption of the Mond power gas process has not extended so rapidly as was predicted, and that the plant in course of construction has not been completed so soon as was expected. Consequently, they cannot put the total output from this source at more than 9300 tons—that is, 2500 tons more than it was in 1903. They acknowledge that they are in violent conflict with authorities who some months ago put the increase at 18,000 tons; but they say that they have obtained their figures from those who know, and that they may be taken as reliable. By means of new plant in the Tyne district, the output of sulphate from carbonizing works has increased 2000 tons. They estimate the production of ammonia, calculated into sulphate (including that used in the manufacture of ammonia soda and for other chemical purposes), from all sources in the United Kingdom, during 1904, at 244,500 tons, apportioned as follows:—

	Tons.
Gas-works	154,000
Iron ,,	19,000
Shale ,,	39,500
Coke and carbonizing works and producer gas	32,000
	244,500

Of this production, they reckon that England contributed 162,400 tons; Scotland, 79,500 tons; and Ireland, 2600 tons. The output (in tons) during the previous five years was as follows:—

	1903.	1902.	1901.	1900.	1899.
Gas-works	150,000	150,000	143,000	142,000	134,000
Iron ,,	19,000	18,500	16,500	17,000	18,000
Shale ,,	37,500	37,000	40,000	37,000	38,500
Coke and carbonizing works and producer gas	27,500	23,500	18,000	17,000	15,000
Totals	234,000	229,000	217,500	213,000	205,500

The authors' estimate of stock in the hands of makers at the end of 1903 was probably not much out, and they therefore assume it to have been correct. The account for the year 1904 will therefore stand as follows:—

	Tons.
Stock brought forward from 1903	12,000
Production in 1904	244,500
	256,500
Exports in 1904	177,000
Home consumption (for all purposes) in 1904	68,500
Stock to carry forward into 1905	11,000
	256,500

The present year, therefore, will open with a moderate stock, though larger than it was at the end of November last, when makers had less in their bins than they have held in any winter month in any recent year. From the point of view of United Kingdom production, Messrs. Bradbury and Hirsch say there does not seem to be anything to fear over the spring months, the probable increase being only small. But while they do not anticipate that the United Kingdom output for January-March will increase more than 3000 tons, they have to contemplate at least a similar increase in Germany and Belgium, as well as some slight increase in France and the United States; and they remark that in all these countries increased production appreciably displaced the British product last year.

Messrs. Bradbury and Hirsch next deal with the question of consumption, which is a far more difficult one, as the determining factors are much more complicated. They, however, indicate what appear to them to be the most important considerations. Continental demand must, they say, receive first attention; for, though it has sunk below that for Spain and the Colonies, its fluctuating character makes it specially important. While prices do not seem to seriously disturb Spanish and Colonial demand, they have very much to do with demand for the Continent; nitrate of soda being to so large an extent an alternative fertilizer when it is relatively cheaper. Earlier in their "Review," they discussed the prospects of the Continental consumption of nitrogenous fertilizers, and expressed the view that they are decidedly favourable; but they say that at present there is nothing in the relative prices to induce reversion to the use of sulphate of ammonia. They think the advance in the price of nitrate has been discounted quite enough by the sulphate trade, and that, in the permanent interests of the trade, it might be better not to attempt to push prices further. On the other hand, there is less margin for a reduction in the Continental demand than there was last spring; and to this extent (7500 tons, January-March) the position has improved. In their opinion, the Colonial demand is far more hopeful; the current year's sugar crop having come upon a splendid market, and the cane sugar growing industry having been really profitable, for the first time for very many years. The United States production seems to be keeping pace with increased requirements, and the article enters so little into use as a fertilizer that increased demand for British production had better not be counted upon. There appears to be no limit to the possibilities of Spain as a market; the shipments to that country in 1904 being no less than 48,500 tons, and the increase within the year 5000 tons. As a customer, Spain is thus an easy first. The authors are not so certain about the demand over the coming spring months; very heavy purchases having been made for shipment over the late months of the past year before prices advanced. There remains Japan to be considered; and after witnessing a demand spring from 3600 tons in 1903, which was a year of peace, to 15,000 tons in 1904, a year of war, there is reason for hoping that something like the 1904 level may be maintained. Messrs. Bradbury and Hirsch think there is no doubt that nitrate of soda will become in Japan a serious rival in the near future; sulphate of ammonia being too heavily handicapped by high freights. This, however, is not a present contingency. If their estimate over the next few months is fairly correct—and they think it is—there can be no cause for apprehension on the ground of production.

With regard to demand, Messrs. Bradbury and Hirsch consider that they have shown reasonable grounds for expecting an increase from all points excepting the Continent and the United States; and they are of opinion that this should more than absorb any increase there may be in production. Indeed, more than this will be required if prices are to be improved or even maintained, as they are comparing the prospects of the coming months with last season's shipments, which up to the end of March left a surplus stock of probably 3000 tons in the hands of makers to upset the market in April. It is therefore necessary to look for an increase in export demand, not of 3000 but of 6000 tons, between now and the end of March; and if there should happen to be a further falling off in Continental requirements, this, too, would have to be made good by increases in other directions. With regard to the Continent, they are of opinion that if there is not much to hope for there can be little to fear; last year's January-March shipments having dwindled down to less than 11,000 tons, owing partly to increased domestic production, but mainly to relative dearness. At present prices, sulphate of ammonia is rather cheaper than nitrate of soda; but as consumers are not showing any disposition to buy either the one or the other for spring delivery, it is difficult to determine what their policy is likely to be. Against a shrinkage in Continental requirements, it may further be said that certain areas can, at any rate for the present, best be served from Hamburg, Antwerp, and Stettin, and that these areas have already been narrowed as far as they conveniently can be. On the whole, therefore, Messrs. Bradbury and Hirsch think the advance in prices has been justified; and as, at the time of writing their "Review," there was a good inquiry for January, it seemed likely that, given favourable weather, prompt prices might approximate to those for spring delivery.

The "Review" concludes with the usual record of the course of the market month by month; and this is followed by the customary tabulated statistics. The first table contains the comparative weekly prices of sulphate of ammonia and nitrate of soda last year. In the week ending Jan. 2, sulphate was 12s. 7½d. and nitrate 9s. 9d. per cwt.; on April 2, the prices were 12s. 6d. and 10s. 1½d.; at Midsummer, they were 11s. 11½d. and 10s.; at Michaelmas they were 11s. 9d. and 10s.; while at the close of the year they were 12s. 7½d. and 11s. respectively. The second table shows the average prices per cwt. of 95 per cent. nitrate of soda, in Liverpool, for the past ten years. They are as follows: 1895, 8s. 2¾d.; 1896, 7s. 11½d.; 1897, 7s. 9½d.; 1898, 7s. 6¾d.; 1899, 7s. 11¾d.; 1900, 8s. 5½d.; 1901, 8s. 11½d.; 1902, 9s. 4d.; 1903, 9s. 6½d.; and 1904, 10s. 2½d. The third table gives the average prices per ton of good grey (24 per cent.) sulphate f.o.b. Hull; the figures ranging over 38 years—1867 to 1904. The following are the averages for the past ten years: 1895, £9 15s. 4½d.; 1896, £7 18s. 0½d.; 1897, £7 18s. 4¾d.; 1898, £9 9s. 7½d.; 1899, £11 5s. 9¾d.; 1900, £11 2s.; 1901, £10 11s. 4d.; 1902, £11 16s. 3d.; 1903, £12 9s. 2d.; 1904, £12 3s. 8d.

A Trivial Dispute at Louth.—A dispute has arisen between the Louth Gas Company and the Highways Committee with regard to the removal of a street-lamp and the erection of a new one; the latter having, it is said, been arranged for by the Chairman of the Company without the sanction of the Committee. Such open defiance as this could not, of course, be tolerated; and so Corporation employees were sent to stop the work, with the result that there was "a narrow escape of a breach of the peace" between the two bodies of men. The minutes of the Committee submitted to last week's meeting of the Town Council contained a resolution that the Company be allowed to fix the new lamp, subject to payment by them of the cost incurred through their previous "illegal action;" and Alderman Ingoldby, in moving their confirmation, remarked that such action as the Company had taken would not settle the question of electricity or gas for the lighting of the town. Mr. Dickinson said he understood that several members of the Committee had told the Chairman of the Company that there would be no objection to the erection of the lamp; but nevertheless Alderman Ingoldby ought to be supported. He added that he thought the advocates of electricity had few followers in the town. The minutes were confirmed.

INCANDESCENT GAS LIGHTING IN ST. PANCRAS.

At a Meeting of the St. Pancras Borough Council last Wednesday, the Electricity and Public Lighting Committee submitted a report in which they pointed out that in March, 1903, they recommended the Council to sanction about 1000 of the present open-flame gas-lamps being replaced by incandescent lanterns and burners; but, on the recommendation of the Finance Committee, this number was reduced to 500—the cost to be met out of the rates levied for the following half year. In March, 1904, the Council accepted a tender for carrying out the work at a cost of £842. The work has now been completed, and the lighting has been considerably improved. There are other thoroughfares where it is anticipated it will be some time before electric mains will be laid so as to enable these streets to have the advantage of being electrically lighted, and the Committee expressed the opinion that meanwhile the inhabitants should have an improvement in the present lighting. They therefore recommended that the Council should provide in the next rate an estimated sum of £850 to enable a further 500 incandescent gas-lamps to be substituted for the existing open-flame burners. The report and recommendation were adopted without discussion or dissent.

SOUTHPORT CORPORATION GAS SUPPLY.

Charges for Hiring Cookers—Gas-Fitting Rules—Lighting the Town.

The Southport Corporation Gas Committee have resolved to make a considerable reduction in the prices charged for the hire of gas cooking-stoves. On the new lines, it is decided to charge 20 quarterly payments extending over five years instead of three. At the end of the period, the cooker becomes the property of the customer. Terms for simple hire are also being adjusted. The new prices will be about 40 per cent. less than those now charged; and the system will come into force on the 31st of March. The Committee have framed a set of very important rules to be observed in fitting up premises to be lighted with gas, so as to ensure a sufficient supply. The reform is considered to be one of the best that has been carried out for many years, and will act as a deterrent to scamped and faulty workmanship. The Corporation decline to fix in future a meter or a service unless the pipes in the house have been laid in a tradesmanlike manner, or until the whole of the fittings and pipes are gas-tight. If only three burners are to be supplied, a ⅜-inch bore, weighing 1 lb 9 oz. to the yard, will be allowed. But should light be required for 50 burners, then a 1-inch bore, weighing 6 lbs. to the yard, must be put in; and so on in proportion to the pressure required. No gas-fire can be supplied from a pipe of less than ⅜ inch diameter; and large gas-fires must have one not less than ½ inch diameter.

The whole of the street lighting arrangements in the borough have been the subject of an inquiry by the Lighting Committee. Recently the Watch Committee passed a strong resolution that the lighting of the streets after 11 p.m. was insufficient for the security of the borough; and the Gas Engineer (Mr. J. Bond) received instructions to supply the police with a numbered list giving the times at which the lamps in the town should be extinguished. The custom is to turn out half the lights at 11.30 p.m., and to put them all out when it is moonlight.

When moving the adoption of the minutes of the Gas Committee at the meeting of the Town Council on Tuesday, the Chairman (Alderman Travis) explained that the Committee had had under consideration for some time the question of making a reduction in the price charged for the hire of cookers, and said they believed the new charges would lead to an increase in the number of these appliances, both in the borough and in the outside districts. They had actually made a profit in the summer months last year; and the bulk of the gas used was for the cookers. The new regulations with regard to the fitting up of premises to be lighted by gas would have a most beneficial effect and could do no harm to reputable gas-fitters. Alderman Dimond seconded the motion. In answer to a question, Alderman Travis said that the new charges were not fully retrospective; but those consumers who had had stoves for some time would be taken into consideration, and they would get some reduction. With regard to the lighting of the town, they could not go very lavishly into it without increasing the rate; and, having regard to due economy, they were wishful to meet the Watch Committee as far as they could. Mr. Holden remarked that they must see that the borough was efficiently lighted, and let the question of economy take a second place. The security of the inhabitants must be looked to; and he did not think this was the case at present. Alderman Travis said he was pleased to give the Council all the light they would pay for. The Mayor (Mr. E. Trounson) said the question of the public lighting of the town had been under the consideration of both the Watch and the Lighting Committee; and he could give the assurance that the latter would do everything they could in the matter. The minutes were adopted.

PUBLIC LIGHTING OF NEW YORK.

A Protest Against Municipal Ownership.

The subject of the public lighting of New York has lately been brought into prominence, as our readers are aware, by the strictures passed by the "New York American" on the Commissioner of the Water Supply, Gas, and Electricity Department (Mr. J. T. Oakley), in respect of his action in arranging the contract with the United Gas and Electric Companies for the lighting of the city (*ante*, p. 23). Complaint was made not only of the quality of the gas but of the charge; and a clamour was raised for municipal control. Some remarks in defence of the lighting of the city were recently addressed to the "New York Sun" by Mr. Homer G. Parsons; and it is only fair to give them as representing the views of the other side.

When Lord Kelvin was in New York some time ago, he spoke of it as the best lighted city in the world. Is not some of the credit for this condition due to the men who have developed our lighting companies? Instead we hear indiscriminate abuse of them because of their bills for lighting, as if they were simply robbers of the public; and now the Citizens' Union propose to work for a lighting plant under municipal control.

Much is printed about the efficacy of municipal ownership of public utilities in Great Britain. The plan is said to work perfectly in England and Scotland, so that it is taking a firmer hold every day. But what are the facts? In the past two years there have been several important and significant sales of plants by municipalities and townships to private companies in both England and Scotland, and there is a distinct tendency in these countries to encourage the American idea of company enterprise, as may be ascertained if one follows the reports of the British trade journals devoted to the subject. Moreover, municipal ownership in Great Britain is not what it was a few years ago—in 1896—when Governor Altgeld, of Illinois, came home from abroad with the hope that it would be made an American institution. In a speech at Washington Park (N.J.), he extolled the management of the lighting plants in Bristol, Manchester, and Glasgow; but he did not venture to that any one of these cities was as well lighted as is an average American town. The comparison would have been manifestly absurd; and he had sense enough to avoid it, and to cling to the demagogic harangue that American civic progress should have none of the influence of enterprise of the individual.

Philadelphia made such an experiment, and a bitter and costly one it was. The Commission bore the sobriquet of the Gas Trust, just as the consolidation of our lighting companies is now called. It started out with the best of motives and purposes, with a definition of powers similar to the regulation of such commissions in Great Britain; but it was easy to fill the gas-works with political servants. The nucleus of a powerful organization was thus created, and in time it developed into a political tyranny for the city. The making of gas was more a matter of politics than of revenue to the city or satisfaction to the consumer. No attempt was made to improve the quality or cost of the gas, or to adjust the complaints of consumers. Pay-rolls were padded, and the affairs of the gas-houses otherwise manipulated so that a deficit at the end of the year was a regular thing; and councils, dominated by the Commission, generally yielded to requests to help it out.

This was as recently as 1896; but Philadelphia finally rebelled, and threw off the yoke of municipal ownership. In the long agitation that brought about the transfer of the gas-works to a private corporation, in 1897, the Hon. John Wanamaker had a conspicuous part; and I dare say no other Philadelphian is better informed on the Quaker City's grievances against municipal management of a public utility. Former Mayor Warwick, who signed the ordinance effecting the transfer, told me recently that in his opinion the theory is absolutely un-American, and that if he were Mayor of New York he would veto any measure which aimed to put any public utility under municipal control. I have talked with many Philadelphians on the subject, and they all agree with Mr. Warwick's view. I also made some inquiries among gas engineers in Philadelphia as to the quality of gas we now get in New York, and its method of manufacture, distribution, and cost. One well-known Philadelphia engineer said unhesitatingly that we get the finest and best illuminating gas that can be manufactured; also that we have such splendid facilities for manufacturing gas, that gas engineers and manufacturers from all parts of the world come to New York to seek instruction as to the advancement of the industry.

From engineers in Boston and Philadelphia I have learned that we use carburetted water gas and also coal gas. Carburetted water gas is really what is generally consumed; no straight coal gas being distributed in New York. Coal gas falls short of the requirements of the law as to illuminating efficiency, and it is necessary to mix it with water gas to bring it up to the legal standard. Carburetted water gas is produced by passing superheated steam over carbon, generally anthracite coal. An enrichment process—naphtha or oil—is added to produce the illuminating power; and this process, engineers say, adds to the cost of manufacture. The cost of manufacture of gas in our cities is very much higher than abroad, for the candle power required in many European cities is so low that straight coal gas, which has practically been discarded here, will fill the bill. The law requires 20 candle power gas in New York—the highest standard of illumination. The possible dangers in the use of water gas were carefully considered for several years by the engineers before they would give their sanction to the adoption of the gas. But the conclusion was reached that, properly used, water gas entails no more risk to the consumer than other kinds of illuminating gas; hence the general use of the gas in our cities. On this point I asked the views of chemists, one of whom was Dr. E. G. Love, the Chemist for New York City. Dr. Love told me that the percentage of carbonic oxide in the gas we get runs from 18 to 25, which he said is not excessive; and that the gas does not menace the health of the consumer, if properly used. Gas men have not yet been able to find a gas giving better results with less hazard than carburetted water gas.

Before we take the advice of the Citizens' Union to put our lighting utilities under municipal control, let us find out why Cleveland refused to adopt it by popular vote, and what it means to the little city of Wheeling, now labouring under its disadvantages. How would such a department of the public service work in a city where party strife and factional ambition are so keen as in New York? How long would our local political organizations be content with a municipal lighting plant without getting a whack at spoils which conditions have kept from their reach for many years? Compared with Philadelphia and other large cities, the prices charged for gas and electricity in New York are reasonable—at any rate, we are no more at the mercy of gas companies than they are. Moreover, the fact remains, as Lord Kelvin said, that New York has now a system of gas and electric illumination which makes it the best lighted city in the world.

It is reported that the Water-Works Committee of the Bolton Corporation contemplate the afforestation of the Council's watershed as a means of providing work for the local unemployed, who total nearly 2000.

ELECTRIC LIGHTING FAILURES AT ILFORD.

Incandescent Gas for the Lecture Hall.

According to the writer of the column of local chat in the "Ilford Recorder," there was "weeping and wailing and gnashing of teeth" among many of the users of the electric light on the Cranbrook Park Estate last Friday and Saturday week. Quite early in the evening, the current failed altogether in some houses, became enfeebled in others, and in a number of instances gave a quivering light throughout the evening. The result was that "householders dived into their cellars and refurbished their discarded oil-lamps, or fell back upon their store of 'dips.'" Some of the houses had no return of the lost current until the Saturday night. Owing to the recent failure of the electric light at the Town Hall while a concert was in progress, as recorded in the "JOURNAL" for the 3rd inst., emergency gas-fittings are to be put up. In the lecture hall adjoining the High Road Congregational Church, incandescent gas lighting has been installed and electric lighting abandoned. According to the writer above referred to, economical considerations have influenced the promoters of this change. He says the building is certainly well lighted, with its eight gas-jets, whereas 32 electric lamps were previously in use; and the cost is said to be only about one-half. At the meeting of the Urban District Council on Tuesday, Mr. Gaunt had a notice on the paper of his intention to refer to the frequent failure of the electric light, and to discuss the advisability of asking the Electric Light Committee to bring up a special report thereon. He explained that for some time he had not been satisfied personally with the electric light in the district where he lived. By the courtesy of the Chairman of the Lighting Committee, he attended their last meeting, when the matter was gone into, and certain alterations were agreed to be made. Since that meeting he had been in communication with the Chairman of the Committee, who had agreed to accept the motion of which he had given notice; and therefore he should now formally move it, and ask the Council to adopt it. Mr. Bailey seconded the motion, and said it was very desirable that the matter should be gone into fully by the Committee, and a report brought up. Mr. Bodger, as Chairman of the Committee, accepted the motion, and it was accordingly carried.

TORQUAY ELECTRICITY SUPPLY.

Loss of Capital by the Proposed Removal.

Mr. H. Ross Hooper, M.Inst.C.E., resumed at Torquay on Thursday last his inquiry, on behalf of the Local Government Board, respecting the Corporation's application for authority to borrow £42,000 for a new electricity station.

At the outset, the Inspector remarked that the additional information which had been furnished by the Town Clerk made it clear that some thousands of pounds would have to be placed to a loss account by superseding the present station. The capital outlay on the building, and to a certain extent on the machinery, would be lost. He had seen the plant in the station, and what it was proposed to do; and though the Electrical Engineer was making the most of what he had, the fact remained that there would be between £8000 and £9000 which would have to be deducted from the present application. The Town Clerk (Mr. F. S. Hex) pointed out that the new works were estimated to cost £42,000, so that if £9000 were deducted there would only remain £33,000 to carry them out. It was impossible that the £9000 should be charged against revenue, especially one year's revenue; and the question arose whether it would not be necessary to open a suspense account for a few years, which was a very bad look out. Seeing the success of the undertaking had been demonstrated by the use of the present station, he suggested that the amount of the loans contracted for this site should remain to be dealt with as now, and that the Corporation should also pay the principal and interest on the new loan. If this proposal could not be adopted, he would suggest that they should go on with the works, and that in the meantime steps should be taken with a view to the issue of a Provisional Order giving them extraordinary borrowing powers with regard to a probable deficit. It must be remembered that if the Corporation had not adopted the present site and made the old coal-storage cellars at the harbour available for the purpose, they must have handicapped the undertaking from the start with the cost of an expensive building elsewhere. It was true that £2000 had been spent in connection with the present building; but this was a much smaller loss than would have occurred if otherwise. The circumstances were unique; and he strongly appealed to the Inspector of the Board to look at them in an exceptional way. The demand had outgrown the supply from the present generating station; and it was absolutely necessary for a new station to be provided, apart from the question of supplying current for the proposed tramways. The Inspector said it was impossible to know what the Board would do; but it would have to be recognized that the £9000 would be unproductive capital expenditure. At 6½ per cent., this was nearly £600 a year for 25 years—a serious charge on the undertaking. The Town Clerk thought they would be able to meet it if it were dealt with in the way he suggested. Since the works were opened in March, 1898, they had made a net profit of £439, of which £400 had been placed to the reserve fund; and they had also stores in hand to the value of £371, making the total profit £811. The undertaking had thus paid its way. With regard to the new station, it was estimated that the income for the first year would be £4065, including £3572 from the tramways, and that the expenditure, including interest and sinking fund on the old as well as the new loan, would be £10,843—showing a surplus of £222. The Inspector said the figures looked very nice on paper; but he thought the income from the tramways was over-estimated, and the number of running hours put too high. If they reduced the estimate from 106 hours per tramcar per week to the average of from 70 to 80 hours, they reduced the estimated revenue by 20 per cent., or about £500. This was equal to a penny rate, and would have to be met each year as it arose.

Mr. Mackenzie, representing the Tramways Opposition Committee (a body of local ratepayers), and several ratepayers, spoke against the scheme—some on the ground that the Corporation ought to leave the Tramway Company to provide their own electricity, and others because of the financial risk involved in the proposed undertaking.

The inquiry then closed.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 152.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
530,000	10	Oct. 13	10½	Alliance & Dublin 10 p.c.	20½—21½	..	4 17 8
100,000	10	,,	7½	Do. 7 p.c.	14—15	..	5 0 0
200,000	5	Nov. 11	6½	Bombay, Ltd.. . . .	6—6½	..	5 0 0
140,000	5	,,	6½	Do. New, £4 paid	4½—5	..	5 4 0
50,000	10	Aug. 31	14	Bourne- } 10 p.c. . .	29—30	..	4 13 4
251,810	10	,,	7	mouth Gas } B 7 p.c. .	16—17	..	4 2 4
53,200	10	,,	6	and Water } Pref. 6 p.c.	14⅜—15½	..	3 17 5
380,000	Stk.	Aug. 12	12	Brentford Consolidated	250 - 255	..	4 14 1
300,000	,,	,,	9	Do. New . . .	190—195	..	4 12 4
50,000	,,	,,	5	Do. 5 p.c. Pref. .	130—135	..	3 14 1
206,250	,,	Dec. 15	4	Do. 4 p.c. Deb. .	105—108	..	3 14 1
220,000	Stk.	Sept. 15	11	Brighton & Hove Orig.	228—233	+1	4 14 5
246,320	,,	,,	8	Do. A. Ord. Stk. .	168—173	+1	4 12 6
460,000	20	Sept. 29	10	British	41—42	+½	4 15 3
100,000	Stk.	Aug. 12	6	Bromley, Ord. 5 p.c. .	117—122	..	4 18 4
165,700	,,	,,	4½	Do. do. 3½ p.c. .	92—95	..	4 13 9
500,000	10	Oct. 13	7	Buenos Ayres (New) Ltd.	11½—12	+¼	5 16 8
250,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
150,000	20	July 14	8½	Cagliari, Ltd.	24—26	..	6 6 11
100,000	10	Sept. 29	10	Cape Town & Dis., Ltd.	16¾—16¾	..	5 19 5
100,000	10	Oct. 27	4½	Do. 4½ p c Pref. . .	9¾—9⅞	..	4 12 4
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	51—53	..	5 13 2
50,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	100—102	..	4 8 3
1,375,000	Stk.	Aug. 31	5⅝	Commercial 4 p.c Stk. .	117—120	..	4 6 8
560,000	,,	,,	5	Do. 3½ p.c. do. .	113—116	..	4 6 2
450,000	,,	Dec. 15	3	Do. 3 p.c. Deb. Stk.	86—88	+1	3 8 2
800,000	Stk.	,,	6½	Continental Union, Ltd.	117—120	+1	5 8 4
200,000	,,	,,	7	Do. 7 p c. Pref.	140—145	..	4 16 7
424,070	Stk.	Aug.	5	Derby Con. Stk. . . .	121—122	..	4 2 0
55,000	,,	Jan. 3	4	Do. Deb. Stk. . . .	108—110	..	3 12 9
486,090	10	July 14	11	European, Ltd. . . .	20½—21½	..	5 2 4
354,060	10	,,	11	Do. £7 10s. paid	14—15	..	5 10 0
15,243,200	Stk.	Aug. 12	4⅛	Gas- } 4 p.c. Ord. . .	103—104	+1½	4 4 7
2,600,000	,,	,,	3½	light } 3½ p.c. max. .	93—95	..	3 13 8
3,799,735	,,	,,	4	and } 4 p.c. Con. Pref.	110—112	+1	3 11 5
4,193,975	,,	Dec. 15	3	Coke } 3 p.c Con. Deb.	87—89	..	3 7 5
258,740	Stk.	Sept. 15	5	Hastings & St. L. 3½ p.c.	100—103	..	4 17 1
70,000	10	Sept. 29	11	Hongkong & China, Ltd.	16—17	..	6 9 5
3,800,000	Stk,	Nov. 11	10	Imperial Continental .	212—214	+1	4 13 6
473,600	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	96—98	..	3 11 4
175,036	Stk.	Aug. 31	6	Lea Bridge Ord. 5 p.c. .	118—123	..	4 17 7
561,000	Stk.	Aug. 31	10	Liverpool United A . .	222—224	..	4 9 3
718,100	,,	,,	7	Do. do. B .	160—162	..	4 6 5

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
306,083	Stk.	Dec. 30	4	L'rpool Unit'd Deb. Stk.	106—108	..	3 14 1
75,000	5	Dec. 15	5	Malta & Medn., Ltd. .	4—4½	..	5 11 1
560,000	100	Oct. 1	5	Met. of } 5 p.c. Deb..	102—104	..	4 16 2
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100—102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video, Ltd. . .	10—11	..	6 7 3
1,515,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con.	109½—110½	+½	4 1 5
406,025	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 31	10	North Middlesex 10 p.c.	19½—20½	..	4 17 7
52,940	10	,,	7	Do. 7 p.c.	13½—14½	..	4 16 7
300,000	Stk.	Nov. 30	8	Oriental, Ltd. . . .	147—150	..	5 6 8
600,000	5	Sept. 15	7	Ottoman, Ltd. . . .	5½—6½	..	5 12 0
235,005	Stk.	—	6½	Plym'th & St'house 5 p.c.	—	..	—
398,490	5	Apl. 28	5	Primitiva Ord. . . .	5⅛—5⅜	..	4 6 11
796,980	5	July 28	5	Do. 5 p.c. Pref. .	4⅞—5⅛	..	4 15 3
488,900	100	Dec. 1	4	Do. 4 p.c. Deb. .	93—95	..	4 4 3
851,070	10	Oct. 13	7	River Plate Ord. . . .	11⅞—12½	..	5 14 3
300,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. .	94—96	..	4 3 4
250,000	10	Sept. 15	6	San Paulo, Ltd. . . .	12—12½	..	4 16 0
70,020	50	Jan. 3	5	Do. 5 p.c. Deb. .	52—54	..	4 12 7
135,000	Stk.	Sept. 15	10	Sheffield A	238—240	..	4 3 4
209,984	,,	,,	10	Do. B	237—239	..	4 3 8
523,498	,,	,,	10	Do. C	236—238	..	4 4 0
123,998	Stk.	Sept. 29	5	Shrewsbury Ord. 5 p.c.	104½—107½	..	4 13 0
70,000	10	,,	11	South African	16—17	..	6 9 5
6,250,000	Stk.	Aug. 12	5½	South Met., 4 p.c. Ord.	133—135	+1	4 1 6
1,832,700	,,	Jan. 13	3	Do. 3 p.c. Deb.	88—90*	+½	3 6 8
575,000	Stk.	Aug. 31	5½	S'th Suburb'n Ord. 5 p.c.	123—126	..	4 7 4
60,000	,,	,,	5	Do. 5 p.c. Pref. . .	125—130	..	3 16 11
112,533	,,	Jan. 13	5	Do. 5 p.c. Deb. Stk.	130—135*	−½	3 14 1
502,310	Stk.	Nov. 11	5	Southampton Ord. . .	105—107	..	4 13 6
87,950	,,	—	4	Do. 4 p.c. Deb.	—	..	—
120,000	Stk.	Aug. 31	6½	Tottenham } A 5 p c. .	123—128	..	4 17 8
325,520	,,	,,	4¾	and } B 3½ p.c. .	97—102	+2	4 13 2
115,000	,,	Dec. 15	4	Edmonton } 4 p.c. Deb.	102—105	..	3 16 2
182,380	10	,,	8	Tuscan, Ltd.	8¾—9¼	..	8 13 0
149,900	10	Jan. 3	5	Do. 5 p c. Deb. Red.	94—96	..	5 4 2
30,000	Stk.	Aug. 31	7¾	Wands- } A 5 p.c. . .	160—165	..	4 13 11
255,636	,,	,,	6½	worth } B 3½ p.c. . .	133—138	..	4 10 7
51,299	,,	,,	5½	and } C 3½ p.c. . .	110—115	..	4 13 6
57,564	,,	Dec. 30	3	Putney } 3 p.c. Deb. Stk.	77—82	..	5 13 2
745,872	,,	Aug. 12	5	West Ham 5 p.c. Ord. .	101—103	+1	4 17 1
85,000	,,	,,	5	Do. 5 p.c. Pref. . .	122—127	..	3 18 9
160,000	,,	Dec. 30	4	Do. 4 p.c. Deb. Stk.	101—106	..	3 15 6

Prices marked * are Ex div.

BRISTOL WATER SUPPLY.

With the view of augmenting the water supply of Bristol, the Water Company have lately brought into use their new Blagdon reservoir. The extension scheme they have carried out is a very large one; a lake 1¾ miles long, extending over an area of about 500 acres, and capable of holding 1700 million gallons of water, having been constructed. The Company are to be congratulated on the completion of an undertaking which has engaged considerable attention for some years. Legislative sanction was given to the project in the session of 1888; and operations were started a couple of years later. The following particulars will give an idea of the scope of the scheme. The Yeo Valley works, which were authorized by Parliament, included the Yeo storage reservoir, works for utilizing the Rickford spring, and the necessary pipes for conveying the water from this source to the reservoir; works for utilizing the Langford spring, and similar means for taking the water to the Yeo works; a pumping-station adjacent to the Yeo reservoir; pipe-lines to the Barrow reservoirs and filter-beds; and some drainage operations. The reservoir is one of the sixth largest in Great Britain. In the construction of an extensive embankment at the west end, a great public improvement has been effected—a broad roadway replacing a narrow lane which used to cut across the valley from Butcombe to Blagdon. The pumping-station, close at hand, is equipped with machinery of the most improved character; the engines being of the compound rotative beam type, equal to meeting the heaviest requirements. The water is pumped through pipes to the North Hill tunnel, a distance of 5 miles. A feature of the undertaking was the drainage scheme which had necessarily to be connected with it in order to ensure as much purity as possible to the water. This has been carried out with thoroughness. The Company was founded in 1846; and the area over which their operations extend is estimated at 60 square miles, projecting in several directions beyond the city boundaries. There are 300 miles of mains, which furnish a daily supply of upwards of 10 million gallons of water.

WATER-WORKS PURCHASE QUESTION AT SUNDERLAND.

The Sunderland County Borough Council, at their meeting last week, appointed a Committee "to gather information as to the desirability of purchasing the undertaking of the Sunderland and South Shields Water Company, either alone or in conjunction with the other authorities interested."

This step was taken on the proposition of Mr. Summerbell, who embraced in his motion the statement—"That this Council regret the action of the Sunderland and South Shields Water Company in increasing the water-rate in various parts of the borough, more particularly in cases where no increased assessment of property has taken place." In introducing his resolution, he denied any feeling of vindictiveness against the Company, the controllers of which had his highest respect. He admitted that, in raising the water-rate along with the assessment, they were doing what they were legally entitled to do. He, however, had received an intimation from the Company stating that, in consequence of the re-valuation of his property by the Assessment Committee, his water-rate would be raised 1s. per annum. As a matter of fact, his house had not been re-valued or re-assessed; it was rated now the same as it had been for several years, and therefore no such demand ought to have been made. Legally, however, the Company had the right to make the demand, though it was wrong to say it was due to increased assessment. This increase in the water-rate was a matter which every member of the Council should carefully weigh in his mind. It did not necessarily follow that there was an increase in the consumption of water because a person had to pay increased rent or rates—in fact, it was safe to say that in 90 per cent. of the cases the consumption remained the same as it was previous to the increased assessment. They got nothing whatever in return for the increase. Therefore he hoped they would express the opinion that, though the Company were legally right, the Council were against having to pay the increased rate without obtaining increased value. The tendency of the Sunderland water-rate would be ever upwards in contrast with other towns of municipal enterprise, where the tendency was downwards; and he asked the Council to say that the time had arrived for serious inquiry into the question. In his opinion, the subject was not one of too great magnitude if they faced it in the right spirit, and got the other municipalities, district councils, and parish councils interested to act in conjunction with them. In 1846, a handful of men were allowed to get the natural rights of the people of Sunderland in regard to the water supply. He felt ashamed of the men who governed the town at that time. Since then, the Company had gone on adding to their capital without opposition; and next session they intended to ask Parliament for power to borrow £750,000 more. The question was complex, inasmuch as a number of different authorities were concerned; but a similar difficulty had been overcome at other places. He thought that if the cost was worked out at so much per pound ratable value, the undertaking would not be too great so far as any particular authority were concerned. He knew it would be said that they were going fast to the Bankruptcy Court—that they had sufficient undertakings in hand to last them for a considerable period, that the time was not opportune, and that they ought to pause and consider. If the time was not opportune now, he was certain it would not be more so a year hence, after another £750,000 worth of capital had been secured. In dealing with the question, they must realize that water was not like tramways or electricity. They might have a new system of trams in ten years, or their electricity plant might in that time be obsolete; but the water was there for ever. Moreover, water was an absolute necessity. It would have to be municipalized some time; and the longer the delay the greater would be the difficulty, and the worse would it be for the ratepayers.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

To-night, in Glasgow, the Western District of the Scottish Junior Gas Association held their fourth meeting for the reading and discussion of papers. In this matter they have gone ahead of their brethren of the Eastern District, which is probably to be accounted for by the larger membership which they possess. The meeting held to-night makes it clear that, notwithstanding the severe drain upon their resources, the fountains of knowledge are not yet dried up; nor have they the least appearance of being so, for there are yet two other such meetings to take place. The President—Mr. J. Lowe—said that the Association would have been the poorer had Mr. Fairweather curtailed his very interesting paper upon the construction of gasholder tanks. It is impossible not to recognize the immense value of Mr. Fairweather's paper, and more especially in that a great part of it consisted of a detailed description of how the gasholder tank at the new Corporation gas-works at Kilmarnock was constructed. When Mr. Fairweather to some extent left the personal and directed his attention to the general, he again gave information which is of great value, because of his crystallizing of the results obtained, partly by himself, in the construction of different forms of tanks. In his figures there ought to be much guidance for others who may be contemplating the construction of a tank. In the discussion, Mr. W. A. White, of Falkirk, raised a question as to the power of local authorities over owners of gas-works in the matter of plans. I could not give information on the subject in the meeting; but I can give it here. It is to the effect that even where there are parliamentary powers, the jurisdiction of the local authority is absolute. I say so upon the authority of an action which was decided in the Court of Session at Edinburgh some years ago. I have mentioned it in this column before, but will repeat it. The Caledonian Railway Company were pressed by the Corporation of Edinburgh to improve an overhead bridge which was so low as to be believed to be dangerous to the traffic upon the thoroughfare it crossed. The Company obtained parliamentary powers to improve the bridge; plans of the proposed alterations being, of course, lodged with Parliament. Notwithstanding this, when they proceeded with the work, they were sued by the Corporation for a penalty for not having obtained the sanction of the Dean of Guild Court to their plans. The Railway Company resisted the crave of the Corporation, but were worsted; the Court of Appeal holding that the Dean of Guild Court—which is the Local Authority—could not be superseded by a local Act of Parliament. I think this case is on all-fours with that of the owners of a gas-works proceeding to erect a gasholder. Mr. Ure's paper, which was practically upon unaccounted-for gas, conformed very much to what I have been advocating should be the character of papers to be read at such gatherings. It dealt with only one subject, which was put tersely. That such papers are specially suitable for an Association of the kind will, I think, be conceded when it is noted that, had time permitted, a very useful discussion would have arisen out of it. I do not depreciate the most excellent productions which have been presented in both districts; I only fear that, at the present rate, the field will soon be exhausted.

Being in Dalkeith recently, I paid a visit to Mr. Alex. Bell, sen., at the gas-works. These works were founded in 1827, with Mr. David Hunter—afterwards of Greenwich, only lately deceased—as Manager. They have undergone several changes since, one of which was in 1854, at the hands of Mr. John Young, the then Manager. Mr. Bell has not long completed the latest alterations, which have also been the most extensive, including the erection of a retort-house, standing at right angles to the direction of the retort-houses which successively preceded it. The site of the works, though not large, had to be negotiated for with five different landowners, which meant a very heavy lawyers' bill. When it was selected as the site for the gas-works of Dalkeith, railways were not in existence. For many years a mineral railway has passed close to the works—now, by the recent extension, running alongside the boundary wall—but it is upon too steep a declivity to allow of a siding being taken into the works from it. Consequently, the advantages of direct railway communication are denied to the works. A capacious coal-store, with separate entrance, has been constructed along the back and at the end of the retort-house. The retort-bench contains five ovens, with settings of fives; the retorts being the customary size of 9 ft. by 20 in. by 14 in. The bench is fired on a regenerative system which is the property of Mr. Bell and his son, the principal feature of which, apart from the scientific basis upon which it rests, is its construction of bricks of ordinary make—only one or two in the whole setting being of special design. A large new holder, 60 feet in diameter by 20 feet in depth, adapted for telescoping, has been erected beside the railway. The tank is a cast-iron one; the nature of the ground—very loose running sand—practically precluding any other form of construction. The new holder is one of two of the same dimensions and capacity. The tank of a small disused holder has been utilized as a tar-well, in connection with which there are some ingenious pumping arrangements. The alterations included the erection of a Young's washer, and the fitting up of one of Walker's three-blade exhausters, driven by a Crossley gas-engine. It will be generally conceded that it was greatly to Mr. Bell's credit that he was able to carry through all these extensive alterations without the making of gas being stopped for a single day, the difficulty of which was greatly increased by the alteration of the direction of the retort-house. Another feature of the alterations is the extensive use of plant already employed in them—the fact being that Mr. Bell, in anticipation of the alterations, had been quietly renewing his plant, as it wore out, with sizes which would be found suitable for incorporation in the larger works.

At the Leith Town Council on Tuesday, Mr. Cochrane moved that it be an instruction to the representatives of the Council on the Gas Commission to press for an early reduction in the price charged for gas

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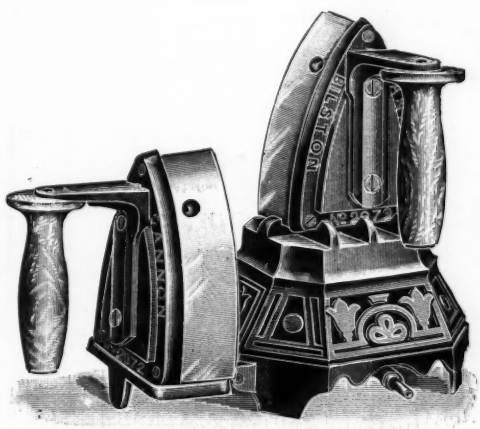

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supplied through prepayment meters. They knew, he said, that in other towns where these meters were in extensive use, the charge made was very much less than that which was made by the Edinburgh and Leith Gas Commission. In Edinburgh and Leith, the charge was 1d. for 20 cubic feet of gas, which worked out to 4s. 2d. per 1000 cubic feet. This, against the rate charged to ordinary consumers—2s. 9d. per 1000 cubic feet—was, he thought, grossly exorbitant, and unfair to those who used prepayment meters. He considered the Gas Commission might wisely reduce the price at present charged. Perhaps 25 cubic feet for 1d. would be a very good compromise in the circumstances. After some discussion, in which Bailie Bryson and Provost Mackie took part, the motion was put to the meeting, and was lost by 13 votes to 3.

A special meeting of the Midlothian County Council was held in Edinburgh on Wednesday, to consider the action to be taken by the Council in connection with the Esk Valley Power Gas Provisional Order. The Chairman—Colonel Dundas—said that a Committee had been appointed to look into the matter and take the steps necessary to protect the Council's interest. Colonel Trotter, the Convener of the Committee, said they had fully considered the subject; and he moved that they oppose the Order. The opposition of the Council would be purely of a protective character. The motion was agreed to without any dissentient.

At the Peterhead Town Council on Monday, the recommendation of the Gas Committee to increase the salary of the Gas Manager (Mr. J. Keillor) by £20 per annum was adopted by eight votes to two. It was reported that since the previous meeting 55 ordinary gas-lamps had been converted into incandescent lamps, and that eleven flat-flame lamps had been cut off. There are now 305 incandescent, and 60 flat-flame lamps in the burgh.

The Denny Town Council have this week, on the recommendation of the Gas Committee, resolved that the larger consumers of gas in the burgh be asked to undertake responsibility for, and to ensure against loss by fire, the gas meters on their premises; and they instructed the Gas Manager to approach the consumers on the subject.

The Dundee Town Council last week discussed the subject of procuring waggons to convey refuse from the gas-works to the esplanade. Mr. Ballingall thought it was singular that they should enter into a contract for thirty waggons at the price of £78 10s. each—a total of £2355—and then pay £126 10s. each, or £3795 in all. The matter seemed to have never been before the Works Committee; and he thought it would be better that all contracts should be made through the Town Clerk's office. Treasurer Ritchie said it was intended to meet the charge out of revenue, and not out of capital. He proposed to open a special account to deal with the matter.

The Richmond Gas Stove and Meter Company, Limited, have recently held successful exhibitions in Carlisle, Darlington, and Weston-super-Mare.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Jan.* 14.

Sulphate of Ammonia.

During the week direct buyers have been more in evidence, and considerable purchases have been made; but supplies have been ample, and sellers have not been able to establish any advance. Smaller makers have, in fact, been too anxious to market their output as it has become available, and prices have consequently been somewhat irregular. At the close, however, the quotations are £12 12s. 6d. per ton f.o.b. Hull, £12 13s. 9d. to £12 15s. per ton f.o.b. Liverpool, and £12 17s. 6d. per ton f.o.b. Leith. The forward position is still unchanged; makers remaining firm and buyers not seeing their way to paying the premium required.

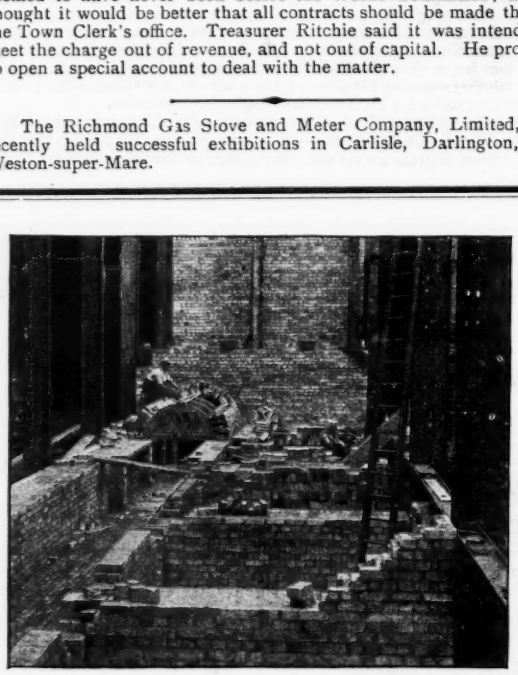
Nitrate of Soda.

This article remains steady at 11s. to 11s. 3d. per cwt., according to quality, on spot.

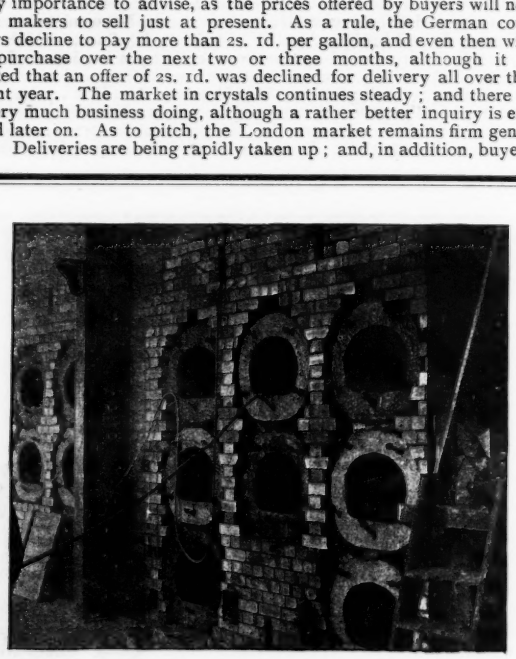
LONDON, *Jan.* 13.

Tar Products.

Markets are generally quiet; and there is very little doing at the moment. There is nothing to report in anthracene; and the position of this article seems likely to remain unchanged for some time to come. In benzol there is really no business to advise. An offer of 10d. per gallon for 90 per cent. f.o.b. London is reported to have been declined for January-June; but against this, some quantity was sold f.o.b. at an out port in the North at 9½d. per gallon for January-June delivery. In 50-90 per cent. there is nothing to advise; but the nominal value may be taken as 7¾d. per gallon, although even at this price consumers do not appear at all anxious to purchase. There is nothing whatever doing in either toluol or solvent; and prices remain practically unchanged. The market in creosote continues quiet all round. Further sales are reported in Yorkshire at 1¾d. per gallon for early delivery; but the large makers still ask 1⅞d., which price buyers decline to pay. In London, second-hand sales are again reported at 1¾d. per gallon, although the largest distillers here still quote 1⅞d., at which price, however, there is really nothing whatever to be done, as there appears to be an absence of demand just at the moment. In carbolic acid the market for crude has been very quiet during the past week, and consumers do not seem at all anxious to purchase. There is no business of any importance to advise, as the prices offered by buyers will not tempt makers to sell just at present. As a rule, the German consumers decline to pay more than 2s. 1d. per gallon, and even then will only purchase over the next two or three months, although it is reported that an offer of 2s. 1d. was declined for delivery all over the present year. The market in crystals continues steady; and there is not very much business doing, although a rather better inquiry is expected later on. As to pitch, the London market remains firm generally. Deliveries are being rapidly taken up; and, in addition, buyers



JULY 25th, 1904.



OCTOBER 15th, 1904.

12 Beds of Inclined Retorts, Erected by us, the whole of the Work being done by our own Men.

RESULTS GUARANTEED.

NEW CONVEYOR CO., LTD., SMETHWICK.

are wishful of removing supplies bought for February. Inquiries resulting from the strike of German miners are on the market. A big business is reported to have been done in South Wales for delivery all over the present year, but at a very low price. As regards Yorkshire makes, there is certainly more offering; but just at present the Belgian consumers do not appear at all anxious to purchase.

The average values during the week were: Tar, 18s. to 22s. Pitch, London, 35s. 6d. to 37s.; east coast, 34s.; west coast, 33s. Benzol, 90 per cent., 10d.; 50-90 per cent., 8d. Toluol, 7¼d. Crude naphtha, 3¼d.; solvent naphtha, 8½d. to 9d.; heavy naphtha, 10d. Creosote, London, 1⅛d. to 1⅝d.; North, 1¼d. Heavy oils, 2 1/16d. to 2⅛d. Carbolic acid, 60 per cent., 2s. 1d. to 2s. 1½d. Refined naphthalene, £4 to £9; salts, 18s. to 21s. Anthracene, "A" quality, 1½d. to 1⅝d.; "B" quality, unsaleable.

Sulphate of Ammonia.

There has been very little business doing during the past week; and prices as a rule remain unaltered. Further business is reported in Beckton at £13 3s. 9d.; but the Gaslight and Coke Company still quote £13 5s. for January-June. The South Metropolitan Company do not report any fresh business; and their quotation remains unchanged at about £13 7s. 6d. for January-February. Business has again been done in Hull at £12 16s. 3d. for January shipment; but makers will not accept this price for forward delivery. In Leith, sales are again advised at £12 17s. 6d. for early delivery, although it is reported that some of the largest makers will not accept this price; while as regards forward business, there is nothing fresh to advise.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The Lancashire coal trade is at the present moment in a better condition than at any previous period during the past six months. The pits are fully employed. Users of slack and burgy have been fairly constant in their demands—so much so, in fact, that colliery owners have generally declined to accept new contracts except at an advance of from 3d. to 5d. per ton. With regard to cannel, the demand has increased. Stocks have decreased everywhere; more is now being asked for than at any time this winter season. There is really a shortage at present in this commodity. Except on new slack contracts, there has been no change in prices, which rule at the pits as follows: Best house coal 13s. to 14s. per ton, secondary 11s. to 12s., common 9s. to 10s., steam and forge coal 8s. 3d. to 8s. 9d., best slack 7s. 6d. to 8s., medium 6s. to 6s. 9d., and common 4s. 3d. to 5s.

Northern Coal Trade.

There has been a better demand for coals the last week or so—partly because the effect of the strikes in Germany drove a few orders into this market, and partly because the manufactories have plenty of work and are using more fuel. The steam coal trade, however, is not quite fully employed, this being the dull season of the year for it. Best Northumbrian steams are 9s. per ton f.o.b., second-class are barely 8s., and smalls are firm at from 4s. 3d. to 4s. 9d. The gas coal trade is active, though the pressure for supplies is less than it was three weeks ago. There is a full demand, and the prices are from 7s. 9d. to 8s. 4½d. per ton f.o.b., according to quality. Several contracts have been in the market of late; and one or two have been settled at something like current values. But as the prices are for coals delivered, the inclusion of the freight—which varies much—rather obscures the price received for the coal. The Copenhagen gas coal contract is also in the market—some 150,000 tons over the season; but the decision will not be known for a week or so. Coke is firm; and gas coke is not quite so abundant. The price for good descriptions of the latter is from 13s. to 13s. 3d. per ton f.o.b. in the Tyne; and some sales over the first half of the year have been made at this price.

Scotch Coal Trade.

There is a better tone in the market all round. A gratifying feature of the trade is a large amount of buying forward; the purchasers being chiefly home manufacturers. Prices for forward delivery are reported to show an advance. The quotations are: Main 7s. 6d. to 7s. 9d. per ton f.o.b. Glasgow, ell 8s. to 9s., and splint 8s. 9d. to 9s. 3d. The shipments for the week amounted to 99,046 tons—a decrease of 129,444 tons upon the preceding week, and of 12,334 tons upon the corresponding week of last year.

TRADE NOTES.

New Carburetted Water-Gas Plants.

The Economical Gas Apparatus Construction Company, Limited, have at the present time a considerable quantity of work in hand on account of their London Office, in the shape of carburetted water-gas plants having a total capacity of 6,800,000 cubic feet per diem. Among the installations on which the Company are engaged are the following: Rochdale Corporation, 1,500,000 cubic feet. Buenos Ayres (New) Gas Company, 1,000,000 cubic feet. Christchurch, New Zealand, 300,000 cubic feet.

The Stirling Boiler.

The Stirling Boiler Company, Limited, and the Stirling Company of the United States have, we have just learnt, come to an arrangement whereby litigation which had been pending between the two Companies for nearly a year has been satisfactorily settled. The Stirling Boiler Company have acquired all the British and European patents of the American Company; and in future all boilers sold in these markets will be of British manufacture. The Company's works at Motherwell are well equipped for dealing with a large volume of business. Both the American four-drum type and the British five-drum Stirling boiler will be sold in this country.

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. TELEGRAPHIC ADDRESS: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	TONBRIDGE	300,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	STRETFORD	500,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	OLDBURY	300,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	TODMORDEN	500,000
BIRKENHEAD	2,250,000	ST. CATHERINES (2nd Cont.)	250,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	YORK (Second Contract)	750,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	ROCHESTER (Second Contract)	500,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	NEWPORT (MON.)	250,000
HALIFAX	1,000,000	YORK	750,000	TOKIO, JAPAN	1,000,000
TORONTO	250,000	ROCHESTER	500,000	PERNAMBUCO (Brazil)	125,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	MALTON	150,000
LINDSAY (Remodelled)	125,000	CRYSTAL PALACE DISTRICT	2,000,000	DULUTH, MINN. (2nd Cont.)	300,000
MONTREAL	500,000	DULUTH, MINN.	300,000	BROCKVILLE (ONT.)	250,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	SMETHWICK	500,000
BELLEVILLE	250,000	LEICESTER	2,000,000	GRAVESEND	300,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	NEWPORT MON. (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	TORONTO (Third Contract)	750,000
		BURNLEY	1,500,000	TORONTO (Fourth Contract)	1,000,000
		KINGSTON-ON-THAMES	1,750,000	MONTREAL, ONT. (2nd Cont.)	1,800,000
		ACCRINGTON	500,000	HAMILTON, ONT.	400,000

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.

AND, IN ADDITION, 6,800,000 CUBIC FEET DAILY; also Coal-Gas Plants at NELSON, B.C., CHATHAM, BERLIN, NAPANEE, OWEN SOUND, CALGARY, and WINNIPEG.

Stafford Gas Supply and the Recent Fog.—During the recent foggy weather, there was a record output of gas at Stafford (namely, 899,000 cubic feet on Dec. 23), and had it not been for the quantity of coal kept in stock, some difficulty might have been experienced in coping with the extra demand. In the course of ten days, it was necessary to call upon the reserve of coal to the extent of 700 tons; and, said Alderman Wright at the last meeting of the Town Council, it was satisfactory to report that this large increase in output was met without a single hitch in any part of the works. This statement was received with applause by the members of the Council.

The Padiham Gas Explosion.—A special meeting of the Padiham District Council was held last week for the purpose of considering the serious explosion which occurred at the gas-works on the morning of the 8th inst. The outcome of keen deliberations was the formation of a Sub-Committee to investigate the affair. The Sub-Committee have visited the gas-works and inspected the damaged shops, but their report has not yet been made public. Mr. Jackson, the Gas Manager, who was not present at the time of the occurrence, states that had the gas been turned off at the time of the outbreak of the fire, there would not have been an explosion. There never was any danger of the fire spreading to the retorts.

Gas-Works Fire at New Shildon.—The recent gale was responsible for a fire at Shildon, at the North-Eastern Railway Soho Gas-Works, which supply gas to New Shildon, the waggon works, and the extensive sidings. Last year a chimney was lengthened; and on Friday week the wind blew with such strength that it was thrown down, and crashed with terrific force through the roof of the retort-house, destroying everything in the way. The fire in the furnaces was scattered, and the place was soon ablaze at one end. The gas was turned off; and as there was not much inflammable material in the retort-house itself, the fire, notwithstanding the wind, did not spread very rapidly, and ultimately the flames were subdued. The damage was considerable; but fortunately nobody was seriously hurt.

The Stockport Gas Deputation to London.—The "Stockport Advertiser" of last Saturday's date says: "Apropos of the visit of the Stockport deputation to London, it should be pointed out that the Gas Committee have every reason to bestir themselves in seeking the best means of effecting absolutely necessary improvements at the gas-works. It will be interesting information to know that the consumption of gas for the six days ending Dec. 24 last reached a total of 21,626,000 cubic feet—the heaviest consumption ever experienced by the department. The fog commenced on the Tuesday, and increased the consumption for that day over the corresponding day of the previous year by 14·24 per cent. Each of the following three days, in spite of somewhat diminished pressure, beat the previous highest record of 3,801,500 cubic feet, made on Dec. 27, 1899, with consumptions of 3,838,000, 3,930,000, and 3,933,000 cubic feet. The gas made per day, which on the Tuesday showed 3,095,000 cubic feet, jumped up on the Friday to 3,720,000 feet, or within about 350,000 feet of the maximum capacity of the works."

The Compensation to the London Water Companies.—According to a report prepared by Mr. Alderman Butter, the representative of the Woolwich Borough Council on the Metropolitan Water Board, the London Water Companies only obtained the following amounts for each £100 claimed by way of compensation: Chelsea, £57; East London, £54; Grand Junction, £69; Kent, £73; Lambeth, £78; New River, £45; Southwark and Vauxhall, £63; West Middlesex, £84. The oldest Company, therefore, has fared the worst.

The Scarcity of Water at Holyhead.—A deputation of the Holyhead Urban District Council who waited upon the Water Company with reference to the recent scarcity of water, report that the Company assured them that the question was being carefully considered, and plans had been prepared for an improvement of the works which would assure an ample supply through future seasons of drought. The deputation informed the Company that if such improvements were not shortly put in hand, it would be necessary for the town to consider the advisability of acquiring the existing works or building new ones of their own.

Warrington Water-Works Extension.—The Warrington Town Council have resolved that application be made to the Local Government Board for sanction to the borrowing of £20,510 to enable them to complete the works at present being carried out in connection with the water-works extension authorized by their Act of 1899. The amount originally borrowed was £147,000; but this has been found to be insufficient. The scheme has, however, proved a great success; the supply of water from the wells and adits being more than three times as much as was anticipated. In fact, it is solely on account of the unexpected quantity of water met with that the estimate has been exceeded.

Budleigh Salterton Water Supply.—A meeting of the ratepayers of BudleighSalterton was held last Tuesday to consider the question of the water supply, with regard to which the District Council are promoting a Bill. The scheme proposed is one of impounding water at Colaton Raleigh, and bringing it by gravitation to the town. The estimated cost is £12,100. At present the town is supplied in part from Sherbrook by gravitation and from Kersbrook by pumping. Mr. J. Palmer (the Chairman of the Council), who presided, said there was plenty of water at Kersbrook; but the additional cost of pumping would make it expensive. As to Sherbrook, the supply from this source could only be increased by the construction of a large storage reservoir. Although the capital outlay of the Colaton Raleigh scheme was larger than would be required at Kersbrook, the Council had come to the conclusion that it was the more economical. As it involved the construction of a reservoir and interference with common rights, it was necessary to obtain an Act to carry it out. Mr. Nichols, of Messrs. Beesley, Son, and Nichols, the Engineers of the scheme, explained the proposals. Considerable opposition was shown to the scheme, on the ground of its cost and of the present high rates; and on a vote being taken, the resolution to promote the Bill was defeated.

S&P

MANCHESTER
M&N
NOTTINGHAM

It will be seen, by an announcement which appears elsewhere, that the Bristol Water Company are about to offer for sale by auction £15,000 of 7 per cent. maximum consolidated ordinary stock, in £100 lots, at the reserve price of £147 each. It is part of the 7 per cent. maximum consolidated ordinary stock, amounting to £970,000, which the Company have power to raise under legislative sanction. The dividend paid on this stock for the half year ending the 30th of June last was at the rate of £5 12s. per cent. per annum.

The first annual social gathering of the Athletic Club of the East bourne Gas Company took place on Friday last, in the shareholders' room, by the permission of the Directors. A capital hot suppers prepared by the caretakers, assisted by members of the Committee, was cooked entirely on the premises. The programme included a couple of competitions in the culinary department. For the best Yorkshire pudding, eight workmen entered; a like number taking part in a "Lightning Breakfast Cooking Contest"—ham and eggs being the constituents. Much interest was evinced in the competitions by the fifty employees present. Prizes were provided by the Director, and other friends. The Secretary of the Company (Mr. J. S. Garrard), the President of the club, presided; supported by Mr. Benjamin Bradford (a Director), Mr. W. H. Hammond (Assistant Manager), and Mr. W. J. Ball (Outdoor Superintendent). The Manager (Mr. John Hammond) was prevented by indisposition from being present. Plenty of good music and the customary toasts provided an exceedingly pleasant evening's entertainment.

Messrs. Robert Dempster and Sons, Limited, of Elland, have received an order from the Powell Duffryn Steam Coal Company, Limited, at the Bargoed Colliery, for four 30-feet purifiers, together with superstructure, elevators, and conveyors. These purifiers are intended to deal with coke-oven gas for gas-engine purposes. The firm have already in hand for this Colliery a three-lift gasholder, with steel tank, of a capacity of 300,000 cubic feet, for storing gas for the same purpose.

The first Council Meeting of the Northern District Gas Companies' Cricket League was held at Tottenham on the 11th inst.—all the clubs competing being fully represented. The Secretary (Mr. C. O. Banks) in his report said he had received letters from the Managers of the Barking and Ilford Gas Companies, who regretted their staffs could not compete in the League during the coming season. He had been very successful in obtaining the names of six officials of the different Companies who would become patrons, and one as Vice-President. He was pleased to inform them that Mr. A. E. Broadberry (the Engineer and Manager of the Tottenham and Edmonton Gas Company), the President, had more than kept his word, when he said he would help the League as much as possible, as he now came to their aid by promising to give a shield; thus putting the final touch to the success of the competition. The Council decided that the Commercial Gas Company's club should be elected members, subject to certain conditions. Then followed the election of patrons, &c., and other business, which brought to a conclusion a very successful meeting.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Ripley Gas-Works. Applications by Jan. 30.
SECRETARY AND MANAGER. West Cheshire Water Company. Applications by Jan. 25.
ASSISTANT MANAGER (with capital preferred) for Commercial Undertaking. No. 4323.
TRAVELLERS OR REPRESENTATIVES. No. 4321.
SUPERINTENDENT OF SERVICE LAYING, &c. No. 4325.
CANVASSER. No. 4322.
WORKING FOREMAN. No. 4326.
WASTE INSPECTOR. Colne Valley Water Company.
GAS METER REPAIRERS. No. 4324.

Manufacturing Firm to take up Patent.

No. 4265.

Tank Waggons to Let. Clayton Aniline Company.

Plant for Sale.

SULPHATE SATURATOR. No. 4314.

Company Meeting.

SOUTH METROPOLITAN GAS COMPANY. Cannon Street Hotel. Feb. 8, Two o'clock.

Loans on Mortgage. Derwent Valley Water Board.

Stocks and Shares.

ASCOT GAS COMPANY. Jan. 31.
BOMBAY GAS COMPANY. Jan. 31.
BOURNEMOUTH GAS AND WATER COMPANY. Jan. 26.
BRISTOL WATER COMPANY. Jan. 26.
CROYDON GAS COMPANY. Feb. 1.
GRAYS GAS COMPANY. Jan. 31.
HYTHE AND SANDGATE GAS COMPANY. Jan. 31.
NORTH MIDDLESEX GAS COMPANY. Jan. 31.
SOHAM GAS COMPANY. Jan. 31.
SOUTH SUBURBAN GAS COMPANY. Jan. 31.
SUNBURY GAS COMPANY. Jan. 31.

TENDERS FOR

Gasholder.

WOKING GAS COMPANY. Tenders by Feb. 11.

Gasholder Tanks (Steel and Concrete).

WOKING GAS COMPANY. Tenders by Feb. 11.
TYNEMOUTH GAS COMPANY. Tenders by Jan. 30.

Oxide of Iron.

DUMFRIES GAS-WORKS.
LEITCH AND CO., Huddersfield.

Pipes.

SHEFFIELD GAS COMPANY. Tenders by Feb. 3.

Retort House.

WOKING GAS COMPANY. Tenders by Feb. 11.

Roof for Retort House.

THAMES VALLEY AND GORING WATER AND GAS COMPANY. Tenders by Feb. 9.

Sulphuric Acid.

HERNE BAY GAS COMPANY.

Tar and Ammoniacal Liquor.

CRAYS GAS COMPANY. Tenders by Jan. 31.
HERNE BAY GAS COMPANY. Tenders by Jan. 28.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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Payable in Advance. If credit is taken, the charge is 25s. a year.

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Subscribers who desire to avail themselves of the reduction in the Subscription by paying in advance for the Year 1905, are reminded that this can only be done during the current month.

All Communications, Remittances, &c., to be addressed to WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

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O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.
JOHN WM. O'NEILL, Managing Director,
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WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, AND WAKEFIELD.

"NUGEPE" CEMENT.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 254 Oldham, and 2412 HOP, London.
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THE First Dutch Bog Ore Co., Ltd.
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General Manager (for England and Wales)—
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E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

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BROTHERTON AND CO., LTD., Ammonia Distillers.
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BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

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BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.

BALE'S FIRE CEMENT, PAINT, AND GAS COAL
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SPECIALLY prepared for the Manu-facture of SULPHATE OF AMMONIA.
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Telegrams: "HYDROCHLORIC, LONDON."
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BROTHERTON AND CO., LTD., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GASHOLDER PAINTING.

PAINTING Work for all kinds of Gas-Works Plant undertaken by contract or otherwise.
FREDERICK BOYALL, 31, Regent's Row, Queen's Road, DALSTON, N.E. Established 1850.

ROBERT DEMPSTER & SONS, Ltd.,
Contractor for Complete CARBONIZING PLANTS and every description of GAS APPARATUS and ELEVATING and CONVEYING PLANT, Rose Mount Iron-Works, Elland.

THE KEITH LIGHT.
OVER 1600 INSTALLATIONS IN DAILY USE.
SEE illustrated advertisement in next week's issue.
James Keith and Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.

COAL GAS TAR wanted.
BEST PRICES GIVEN.
Sharpness Chemical Company, Limited, Sharpness Docks, Glos.

PATENTS AND TRADE MARKS
PUBLICATIONS, "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

SPENT OXIDE.
THE South Metropolitan Gas Company are always open to receive OFFERS of SPENT OXIDE.
Chief Office: 709, Old Kent Road, London, S.E.
Telegrams: "Metrogas, London."

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Exchanged for Spent Oxide.
Read Holliday and Sons, Ltd., Huddersfield.

SULPHATE OF AMMONIA
SATURATORS and all LEAD and TIMBER WORK in Connection with Sulphate Plants.
We guarantee promptness, with efficiency for Repairs.
Joseph Taylor and Co., Central Plumbing Works, Bolton.
Telegrams: Saturators, Bolton. Telephone 0848.

OXIDE OF IRON.
JOHN W. LEITCH & CO., Milnsbridge Chemical Works, Huddersfield, have a quantity for Sale, cheap.
Samples and Price on Application.

GLASS SHADES of every description, for all kinds of Interior **GAS LIGHTING.**
Illustrated sheets on application.
JOHN WALSH WALSH,
Soho and Vesta Glass Works, BIRMINGHAM.
Telegrams: "Vesta, Birmingham."
National Telephone: No. 63.
London Show-Room: 4, Holborn Circus, E.C.

OXIDE OF IRON.
WESTBURY OXIDE is now being extensively used for Gas Purification.
For Price and Analysis write to the New Westbury Iron Company, Limited, Westbury, Wilts.

GAS and Water Works Supplies and Construction Company, Limited, are open to purchase small or large Gas-Works. Constructors for all Gas and Water Work and Main Laying. All Gas and Water Works Plant and Fittings supplied. Gas and Water Works Financed. Shares and Stock accepted in part payment for Work and Materials supplied. Gas and Water Works Shares and Stock Underwritten and Issued.
London Office, 99, Cannon Street, E.C.

GAS LIQUOR WANTED.
Particulars to Major and Company, Limited, Hull.

WANTED, a firm of Good Repute to undertake the MANUFACTURE and SALE of New Patented Apparatus for making Gas. Good profits yielded. The English Patents will eventually BE SOLD to a firm having suitable machinery for the manufacture of the apparatus.
Address No. 4265, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SECRETARY AND MANAGER OF WATER COMPANY.
THE West Cheshire Water Company, of 9, Hamilton Square, Birkenhead, invite APPLICATIONS for the post of SECRETARY and MANAGER.
Applicants must be competent to undertake the duties of a Secretary of public companies, the Supervision of Office Work (including Book-keeping and Cash), the Purchase of Stores, and the Direction of Outdoor work connected with the Laying of Mains and the general duties incident to the supply of water.
The Salary is £250 per Annum, with free House, Fire, and Light.
Applications, with References, should be addressed to the Chairman, not later than the 25th of January.

WANTED, Two Competent Gas-Meter REPAIRERS for a Gas-Works in the South of England. Must have had Experience with both Ordinary and Automatic Gas-Meters. Age about 30.
Apply, by letter, giving References and stating Wages, to No. 4324, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WASTE Inspector wanted who has had Experience with the Deacon System of Waste Prevention. A Practical Plumber preferred.
Application, stating Age, Qualifications, Experience, and Wages required, to be made by letter only, to the Secretary, Colne Valley Water Company, New Bushey, Watford.

WANTED, at once, a Man capable of Superintending Service Laying, Gas-Fitting, Incandescent Lighting (public and private), and any outdoor work in connection with a Gas Company. Wages to Commence £2 per week.
Apply, by letter, giving Age and Experience, to No. 4325, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

ENERGETIC and up-to-date Manager required to undertake control of a Gas-Works producing 24 Million cubic feet per Annum.
Applications, stating Age, Experience, and Salary required, must be sealed and endorsed "Gas Manager," accompanied with Three *copies* of recent Testimonials, and delivered not later than Jan. 30 to the Secretary, Gas Company, Ripley, Derby.

WANTED, by a Gas Company in the North of England, an active Young Man as CANVASSER. Preference will be given to one having a practical knowledge of Gas Apparatus and who is able to prepare Estimates for improved Gas Lighting, Heating, Cooking, &c.
Apply, stating Age, previous Experience, and Salary required, to No. 4322, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TRAVELLERS or Representatives calling upon the Gas Trade and Gas Companies wanted to take up on Commission First-Class Specialities of the highest efficiency, such as Indoor and Outdoor Lanterns, Incandescent Burners, Mantles, &c. Liberal Terms to gentlemen who will push them with energy.
Apply, by letter, giving References, and stating Experience and district covered, to No. 4321, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

A MANUFACTURING Concern closely connected with the Gas Industry, introducing Specialities of the most superior types and having excellent prospects, requires an ASSISTANT-MANAGER, with good Technical and Commercial knowledge. Liberal terms offered to suitable gentleman. One who can invest £2500 to £3000 preferred. Good security given for investment. First-class References given and strictest investigation offered.
Address No. 4323, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, in a West of England Gas- Works, Carbonizing about 1300 Tons of Coal, a WORKING FOREMAN. He must be Competent to look after a Gas and Steam Engine, Regenerative Settings, Oxide and Lime Purifiers, and able to fix Cookers and Meters, lay Mains and Services, Read Indices, Incandescent Lights maintenance, and willing to assist in the general work.
Wages 27s., with House, Coke, and Gas, which may be increased to a good man. None but an abstainer need apply.
Apply, by letter, stating Age, Family, &c., with Testimonials, to No. 4326, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

TO LET ON HIRE.
CYLINDRICAL Tank-Waggons suitable for the carriage of Benzol or Crude Naphthas.
Apply, Clayton Aniline Company, Limited, Clayton, Manchester.

NEW Gasholder, 40 ft. diameter by 12 ft. deep, with Steel Standards; also new STEEL TANK to contain same.
Write J. Wright, 181, Queen Victoria Street, London, E.C.

TO BE SOLD CHEAP—Taylor-made Solid Lead SATURATOR of 3 to 4 Tons of Salt per Twenty-four hours Capacity. Body 1½ inches, bottom 1¼ inches thick lead, with heavy Timber Frame and Cradle. Has well for Sulphate Lifter. Equal to new; replaced by larger size.
For Price and to Inspect, address, in first instance, to No. 4314, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

SPENT OXIDE.
THE Gas Commissioners of the Burgh of Dumfries are open to receive OFFERS for the purchase of SPENT OXIDE, about 150 Tons.
Apply to Mr. Malam, Gas-Works.

HERNE BAY GAS AND COKE COMPANY, LIMITED.
SULPHURIC ACID.
THE Directors are prepared to receive TENDERS on or before Saturday, the 28th of January, 1905, for the supply of about 40 Tons of SULPHURIC ACID, to be delivered during the Year 1905.
Particulars of Contract and Form of Tender may be obtained from the undersigned.
The Directors do not bind themselves to accept the lowest or any Tender.
C. V. Bennett,
Manager.
Beach Street, Herne Bay.

HERNE BAY GAS AND COKE COMPANY, LIMITED.
TAR.
THE Directors are prepared to receive TENDERS for the surplus TAR produced at their Works during the Year ending the 31st of December, 1905.
The estimated quantity is about 40,000 Gallons.
Particulars of Contract and Form of Tender may be obtained from the undersigned.
Tenders to be sent in on or before Saturday, the 28th of January, 1905.
The Directors do not bind themselves to accept the highest or any Tender.
C. V. Bennett,
Manager.
Beach Street, Herne Bay.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. Blakeley, Gas Engineer, Thornhill, Dewsbury

CRAYS GAS COMPANY.
TENDERS FOR TAR.
THE Directors invite Offers for the surplus TAR produced until Dec. 31, 1905.
Particulars will be forwarded on application to the undersigned.
Tanks can be filled on rail.
Tenders, endorsed "Tender for Tar," and addressed to the undersigned, must be delivered not later than Nine a.m. on Tuesday, Jan. 31 inst.
W. B. Mimmack,
Secretary.
Gas-Works, St. Mary Cray,
Kent, Jan. 11, 1905.

WOKING DISTRICT GAS COMPANY.
TENDERS are invited for the supply and erection of a RETORT HOUSE constructed of Steel Stanchions, Roof, and Girders, and covered with corrugated iron.
Specification and Drawings may be seen, and full Particulars obtained from Messrs. W. A. Valon and Son, 140, Temple Chambers, E.C.
The Directors do not bind themselves to accept the lowest or any Tender.
Tenders to be sent in, endorsed "Tender for Retort-House," on or before Saturday, the 11th of February, 1905, addressed to the undersigned.
B. Dennett Holroyd,
Secretary.
5 and 6, Great Winchester Street, E.C.

WOKING DISTRICT GAS COMPANY.
TENDERS are invited for the supply of a Steel GASHOLDER and Steel TANK and its erection at the Woking Gas-Works.
Specification and Drawings may be seen and full Particulars obtained from Messrs. W. A. Valon and Son, 140, Temple Chambers, E.C.
The Directors do not bind themselves to accept the lowest or any Tender.
Tenders to be sent in, endorsed "Tender for Gasholder," on or before Saturday, the 11th of February, 1905, addressed to the undersigned.
B. Dennett Holroyd,
Secretary.
5 and 6, Great Winchester Street, E.C.

GASHOLDER CONCRETE TANK.
THE Directors of the Tynemouth Gas Company invite TENDERS for the Construction, at their North Shields Works, of a CONCRETE TANK, 153 ft. 6 in. diameter and 32 ft. maximum depth inside.
Form of Tender, Conditions of Contract, Specification, Bills of Quantities, and Drawings may be seen at the Engineer's Office, Gas-Works, North Shields, and copies may be obtained upon a deposit being made of Three Guineas (which amount will be returned upon receipt of a *bonâ-fide* Tender in the form prescribed, together with copies of Drawings, &c., lent, by the date required).
Tenders, addressed to the undersigned, endorsed on cover "Gasholder Tank," must be delivered not later than by first post on Monday, the 30th inst.
(Signed) William Hardie,
Engineer and Manager.
Gas-Works, North Shields,
Jan. 13, 1905.

THAMES VALLEY AND GORING WATER AND GAS COMPANY, LIMITED.
Gas-Works Extensions.
Contract No. 4.
RETORT-HOUSE ROOF AND ANNULAR CONDENSER.
THE Directors are prepared to receive TENDERS for the Construction, Delivery, and Erection complete of a RETORT-HOUSE ROOF and ANNULAR CONDENSER at their Gas-Works, Goring-on-Thames.
Specification and Plans (prepared by the Company's Engineer, Mr. George H. Robus, Assoc.M.Inst.Mech.E.) may be seen and Particulars obtained from the London Offices of the Company, 20, Bucklersbury, London, E.C., any day after Wednesday, Jan. 18, 1905 (except Saturdays), between the hours of Eleven and One o'clock.
Sealed Tenders, endorsed "Gas-Works Extensions," and addressed Directors, Thames Valley and Goring Water and Gas Company, Limited, Goring-on-Thames, Oxon., should reach me not later than Thursday, Feb. 9, 1905.
The Directors reserve to themselves the right to accept the lowest or any Tender.
J. Hunt,
Secretary.

TO PIPE FOUNDERS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the following Cast-Iron Spigot and Socket PIPES—viz:

200 2-inch PIPES in 6 feet lengths.
500 3-inch PIPES in 9 feet lengths.
1500 4-inch PIPES in 9 feet lengths.
200 6-inch PIPES in 9 feet lengths.

The Pipes must be cast vertically. The price to include delivery to Sheffield, which must be made in about Two Months from receipt of order.

Tenders, addressed to the undersigned, to be sent in not later than the first post on Friday, Feb. 3, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street,
Sheffield, Jan. 13, 1905.

SOUTH METROPOLITAN GAS COMPANY.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Proprietors of this Company will be held at the Cannon Street Hotel, in the City of London, on Wednesday, the 8th day of February next, at Two o'clock in the afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st of December last; to declare a Dividend for the same period; and to elect Two Directors and One Auditor in the place of those retiring by rotation.

The TRANSFER BOOK WILL BE CLOSED from the 25th day of January until after the Meeting.

By order,
FRANK BUSH,
Secretary.

Offices: 709, Old Kent Road, S.E.,
Jan. 14, 1905.

EUROPEAN GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that an Interim Dividend of Four per cent. will be paid, free of Income-Tax, as usual, on the 1st of February next.

Holders of Share Warrants to Bearer may receive the above—viz., Eight Shillings per Share—on leaving Serial Coupon No. 60 for examination at the Union of London and Smith's Bank, Ltd., Prince's Street, London, three days previously.

And Notice is Hereby Further Given, that the TRANSFER BOOKS WILL BE CLOSED from the 17th to the 31st inst., both days inclusive.

W. WILLIAMS,
Secretary and General Manager.

Jan. 12, 1905.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at MR. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

GAS STOCKS AND SHARES
IN THE
NORTH MIDDLESEX GAS COMPANY.
ASCOT DISTRICT GAS COMPANY.
GRAYS GAS COMPANY, LIMITED.
SOUTH SUBURBAN GAS COMPANY; BOMBAY GAS COMPANY, LIMITED; SUNBURY GAS COMPANY; HYTHE AND SANDGATE GAS COMPANY; SOHAM GAS COMPANY.
TO BE SOLD BY AUCTION BY

MR. ALFRED RICHARDS, at the Mart., E.C., on Tuesday, the 31st of January, at Two o'clock, by Order of the Executor of Mrs. Williams, deceased.

Particulars of Messrs. CHURCH AND SONS, Solicitors, 51 and 52, FENCHURCH STREET, E.C., and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

BRISTOL WATER-WORKS COMPANY.

SALE OF ORDINARY STOCK.

MESSRS. ALEXANDER, DANIEL, AND CO. will SELL BY AUCTION, at the Bank Auction Mart, Corn Street, Bristol, on Thursday, 26th of January, 1905, at Three o'clock in the Afternoon,

£15,000

BRISTOL WATER-WORKS 7 PER CENT. MAXIMUM CONSOLIDATED ORDINARY STOCK, in Lots of £100,

At the reserved price of £147 for every £100 Stock.

The above £15,000 Stock is part of the 7 per cent. Maximum Consolidated Ordinary Stock, amounting to £970,000, created under the powers of the Bristol Water-Works Acts, 1888, 1889, 1895, and 1902.

The Dividend is subject to proportionate diminution whenever the Maximum Dividend to which each class of Ordinary Shares or Ordinary Stock of the Company is entitled shall not be paid in full; but such diminution may be made up in subsequent years.

For further Particulars and Conditions of Sale apply to the AUCTIONEERS, Bank Chambers, Corn Street, BRISTOL; to MESSRS. EDWARD GERRISH AND CO., Lloyd's Bank Buildings, Corn Street, BRISTOL; or to

ALFRED J. ALEXANDER,
Secretary and General Manager.

Bristol Water-Works Office,
Telephone Avenue, Bristol.

THE Derwent Valley Water Board is prepared to receive a limited amount of money upon Mortgage at £3¾ per cent. per annum either for a term of years, not exceeding seven, or repayable at six months' notice from either party.

The Derwent Valley Water Board was constituted by Parliament in 1899 to supply water to the towns of Derby, Leicester, Nottingham, and Sheffield, and the monies required for carrying out the necessary Works are, by the powers of the Derwent Valley Water Acts 1899 to 1904, secured upon the Revenues and Rates of the said Towns in due proportion.

Applications to be sent to Mr. W. Gill Hodgson. Accountant to the Board, Bamford, via Sheffield.

By order,
O. B. STEWARD,
Clerk to the Board.

To Trustees and Others.—By order of the Directors of
THE CROYDON GAS COMPANY.

SALE OF £10,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

HOOKER and WEBB have received instructions to SELL BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Wednesday, the 1st of February, 1905, at Two o'clock precisely, in 114 Lots,

£10,000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK

of the Croydon Gas Company, in lots of from £25 to £100 Stock each. The Reserve and Insurance Funds at Midsummer last amounted to £44,522 8s. 11d.; the paid-up Ordinary Capital at that date was £310,000, whereas the Debenture Stock now amounts to only £45,000, thus showing that the stock offered is a security of the highest class.

Particulars and Conditions of Sale may be had of the SECRETARY, at the Offices of the Company, Katharine Street, CROYDON; at the MART, E.C.; and of the AUCTIONEERS, 4, High Street, CROYDON.

Telephone No. 122 Croydon.

BOURNEMOUTH GAS AND WATER COMPANY

ISSUE OF £10 SEVEN PER CENT. 'B" SHARES.
MINIMUM PRICE OF ISSUE £15 PER SHARE.
SALE BY TENDER OF 1000 £10 SEVEN PER CENT. "B" SHARES,
in Pursuance of the Provisions of the Bournemouth Gas and Water Act, 1896.

NOTICE is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER 1000 "B" SHARES OF £10 EACH (the Dividend on which is limited to £7 per cent.), to be paid up in full on or before the 31st of March, 1905.

The Dividend on the Ordinary Shares for the Half Year ended June 30, 1904, was at the rate of Ten per cent. per annum, with an addition at the rate of Four per cent. per annum under the Sliding-Scale, and on the "B" Shares at the rate of Seven per cent. per annum. Since the 31st of December, 1888, to the 31st of December, 1903, the Dividend on the Original Shares has been at the rate of 13 per cent. per annum.

The net Profit earned in the year ended June 30, 1904, after deducting all charges, including Debenture Interest, amounted to £31,499 6s. 1d., which sum was available for payment of Dividends. During the same Twelve Months, the sum of £2000 was added to Reserve Fund from Profits, and also £707 4s. 1d. from Interest on Reserve Investments, and, after payment of Dividends to June 30, 1904, the sum of £8778 18s. 4d. remained to be carried forward to the Half Year ending the 31st of December, 1904.

Particulars and Conditions of Tender may be obtained at the Company's Offices, Bournemouth, or of the Secretary as under.

Sealed Tenders must be sent to the Secretary not later than Eleven o'clock on Thursday morning, the 26th of January, 1905.

By order,
WILLIAM CASH,
Secretary.

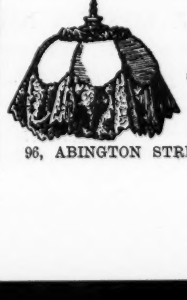
90, Cannon Street, London, E.C.,
Jan. 10, 1905.

Now Ready. Price 5s. 6d. Post Free.

REPORTS OF DISTRICT GAS ASSOCIATIONS FOR 1904.

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

THE "HANWELL" PATENT *Rising and Falling* GAS PENDANT.



An Illustrated Description of this Pendant appeared in the "Journal" for Nov. 22, 1904 (page 599).

Write for full Particulars to the
"HANWELL" Pendant Company,
96, ABINGTON STREET, NORTHAMPTON.

Now Ready, pp. 584 and XVI. 251 Illustrations. F'Cap. Quar o, Price 18s. net (Post Free).

THE SEVENTH EDITION OF

NEWBIGGING'S HANDBOOK

FOR

GAS ENGINEERS AND MANAGERS

(DEDICATED TO SIR GEORGE LIVESEY).

The Work has been revised throughout, and contains 40 pages of Letterpress and 12 Illustrations more than the last Edition.

In almost every department additions have been made; and it is believed that the labour bestowed on its production will enhance the Value of the book as a Work of Reference.

Orders may be sent through any Bookseller, or direct to the Publisher,
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

Gas Companies are solicited to try Samples of the

MIRFIELD GAS COAL

UNEQUALLED.

Sperm Value 878·85 lbs. per Ton.

Prices and Analysis on application.

The MIRFIELD (GAS-COAL) COLLIERIES CO., RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THE PERFECT MANTLE CO$^{Y.}$,

28, Minories, London, E.C.

Manufacturers of Incandescent Mantles.

Importers of all kinds of Fittings & Accessories.

TRY OUR WELL-KNOWN

SUPERIOR "PERMCO" MANTLES.

Illustrated Catalogue Free on Application.
Agents for the "WOLFF LIGHT" INVERTED LAMP.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works

(also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 34, Old Broad Street, E.C.

ALEXANDER CAMERON,
GAS AND CANNEL COAL MERCHANT,
48, WEST REGENT STREET,
GLASGOW.

'BUFFALO' INJECTOR

Operated Entirely by One Handle
Class A lifts 24 ft.
Class B lifts 12 ft.
SEND FOR LIST.
Telegrams: "Temperature, London."
Tel. No. 12,455 Central.
GREEN & BOULDING, — LIMITED, —
28, New Bridge St., LONDON, E.C.

JOHN HALL & CO.,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

SOMETHING NEW.
Mr. Micawber expected something good to turn up.
IT HAS.
"CYCLONE"
WRITE FOR PARTICULARS—
THE
IMPERIAL STOVE COMPANY,
LEAMINGTON.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

THE
"ROTARY"
STATION METER.
Efficiency Demonstrated.
APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE, MANCHESTER.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

HEATHCOTE GAS COAL.
Rich in Illuminating Power and yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

RAILS.
New and Second-Hand with all Accessories; also Tip Waggons and Turntables.
B. M. RENTON,
MIDLAND WORKS,
SHEFFIELD.

The "BRITON" and "RENNIE"
Gas Arc Lamps
(COLBRAN'S PATENT).
VERY STRONG
ORNAMENTAL LAMPS.

REGISTERED.
"V" PATTERN "BRITON" LAMP.
JOHN F. COLBRAN,
THE CROWN LAMP WORKS,
58 & 59, CHISWELL ST., E.C.
Telephone: No. 4199 Central.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address "WIGAN, BIRMINGHAM." Telephone No. 200.
LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "Parker London."

An example in Cast Brass.

DECORATIVE FITTINGS.

For Interior Lighting in the popular modes.

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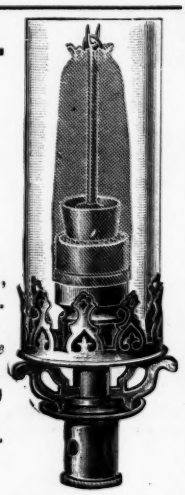

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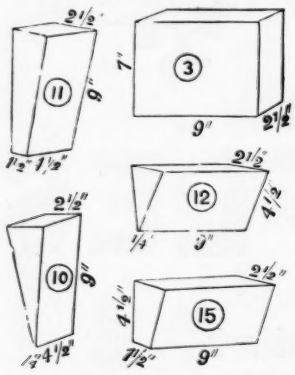

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BRICKS, BLOCKS, TILES, & SHIELDS of any shape made to order.

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MAINTENANCE SIMPLIFIED.

Nothing to Corrode. Nothing to Choke.
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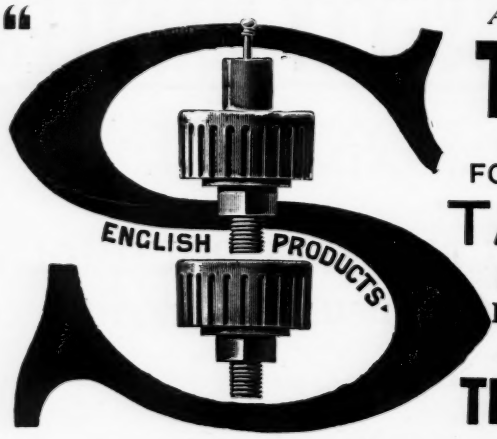

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INCREASED DISCOUNTS TO THE TRADE.

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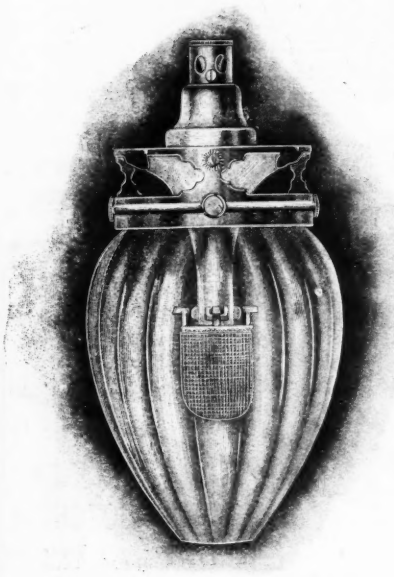

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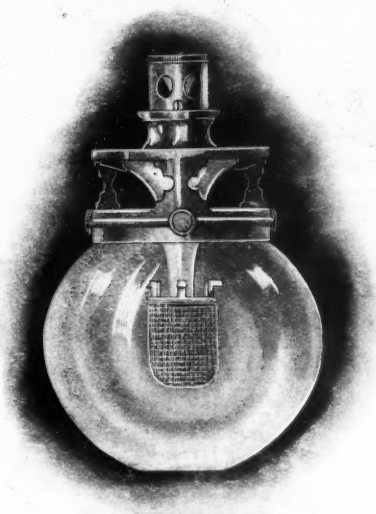

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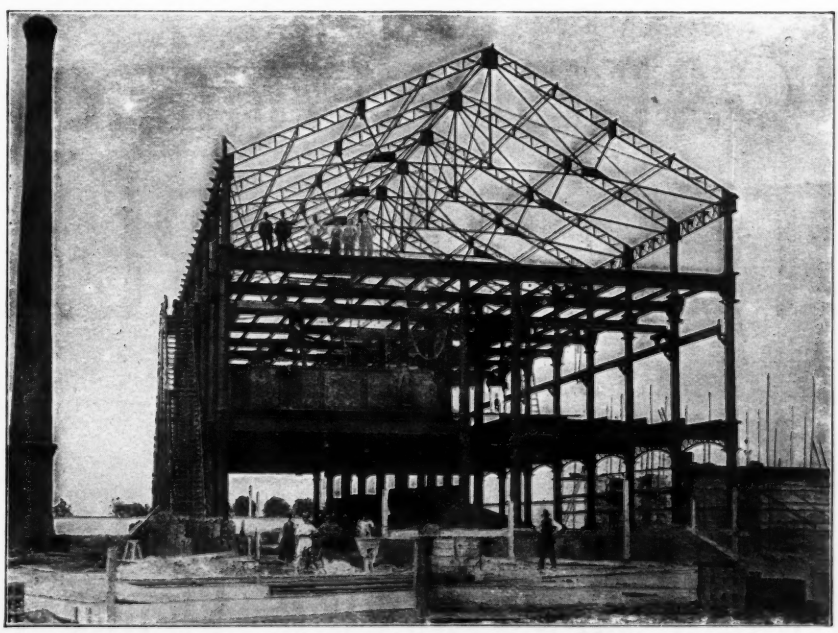

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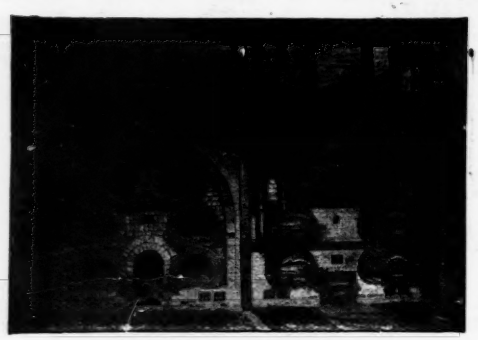

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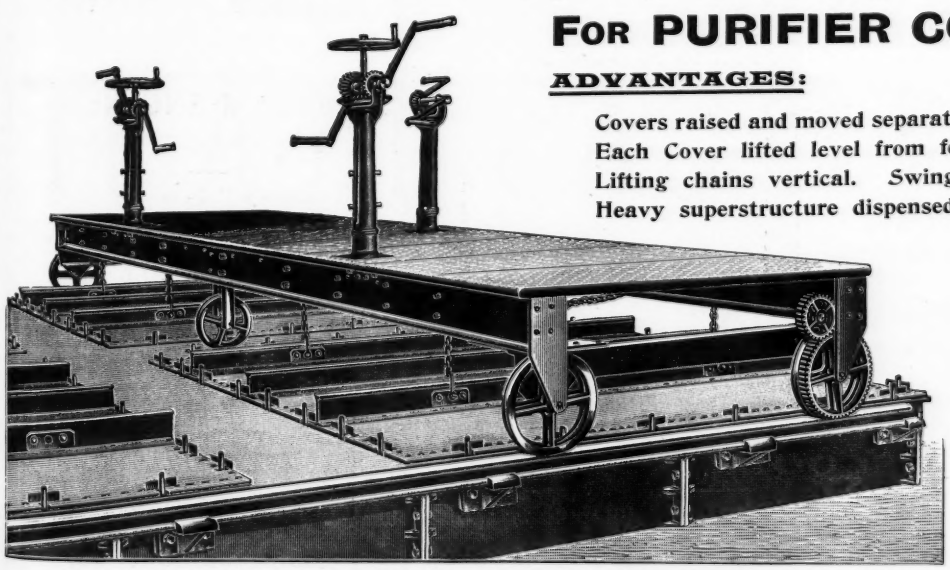

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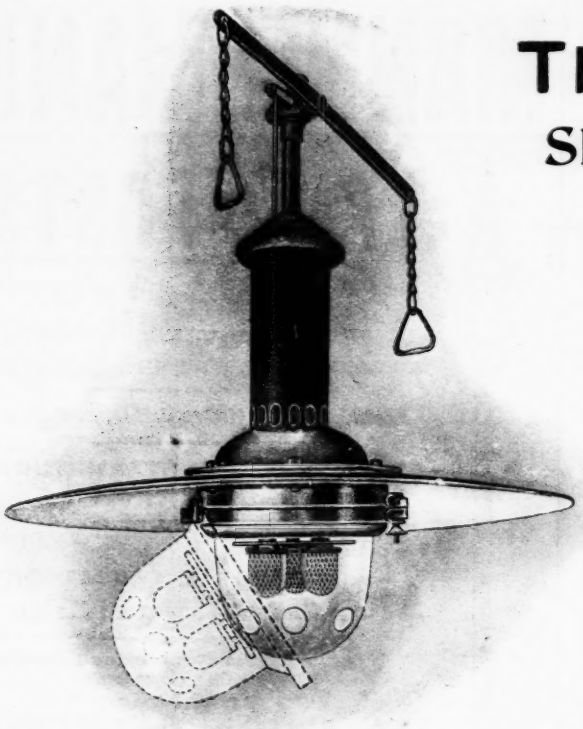

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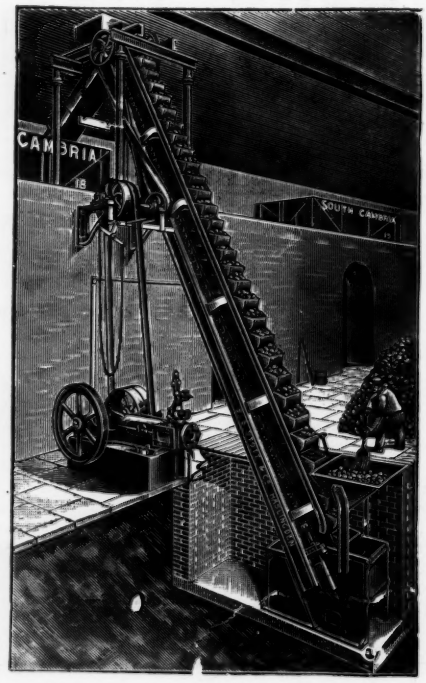

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